VOLUME 14
5/1995
SEPTEMBER/
OCTOBER

INDIAN FOOD INDUSTRY

A PUBLICATION OF ASSOCIATION OF FOOD SCIENTISTS AND TECHNOLOGISTS (INDIA)

CRYOGENICS FOR FOOD APPLICATIONS

Extrusion Cookers and Their Application

Potential of Goat Milk as Health Food

ASSOCIATION OF FOOD SCIENTISTS AND TECHNOLOGISTS (INDIA) MYSORE - 570 013

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* Affiliated to the Institute of Food Technologists, Chicago, Illinois, U.S.A.
* The Association is a professional and educational organization of Food Scientists and Technologists, with its headquarters at Mysore.
* The chapters of the Association the association are located at Bangalore, Bhopal, Bombay, Calcutta, Delhi, Hisar, Hyderabad, Jabalpur, Jaipur, Jammu, Kanpur, Karnal, Kharagpur, Ludhiana, Madras, Manipur, Nagpur, Pantnagar, Parbhani, Pune and Thiruvananthapuram.

Objectives :

* Advancement of all the aspects of Science and Technology relating to production, processing and distribution of food, with the ultimate objective to serve humanity through better food.
* Promotion of research, development and training in the Science, Technology and Engineering of Food.
* To provide a forum for exchange, discussion and dissemination of knowledge and current developments, especially among Food Scientists and Technologists as well as the Public and Society at large.

Major activities :

* Publication of 'Journal of Food Science and Technology' (bi- monthly) and 'Indian Food Industry' (bi-monthly),
* Holding symposia/conventions on different aspects of Food Science, Technology and Engineering
* Arranging Lectures and Seminars for the benefit of Members and the Public.

Membership :

* Membership is open to graduates and diploma holders in Food Science, Technology and Engineering as well as to those engaged in these professional activities.
* Types of membership include Life Member, Life Member (Resident Abroad), Corporate Members, Full Member, Member (Resident Abroad), Affiliate Member, Student Member and Student Member (Abroad).
* Each member will receive a free copy of the 'Journal of Food Science and Technology' or 'Indian Food Industry,' as per the option exercised.

For Membership, Subscription to the Journals and other particulars, kindly contact :

The Honorary Executive Secretary
Association of Food Scientists and Technologists (India)
Central Food Technological Research Institute Campus
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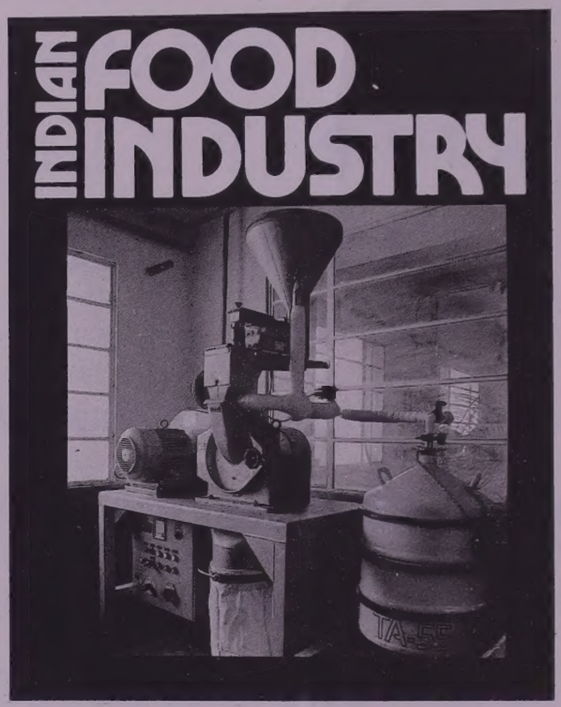
INDIAN FOOD INDUSTRY

VOLUME 14 NUMBER 5



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Cryo-grinder

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Indian Food Industry (ISSN-0253-5025) is a bi-monthly publication of the **Association of Food Scientists and Technologists (India),** devoted to give extensive coverage to technological and market developments relevant to food industries in India.

Review articles, technology papers based on R&D work and reports on various aspects concerning food industry are welcome from food scientists and technologists from industry, research institutions and other related organisations. Contributors are advised to provide good quality illustrations in the form of charts and photographs along with the manuscripts. The Editorial Board reserves the right to edit the manuscripts in order to make them suitable for publication in the journal.

Food industries may send information (suitably illustrated with photographs) about their new products, machinery, business ventures and other developments, which will be published on the discretion of the Editorial Board.

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Printed and published by the Executive Secretary, Association of Food Scientists and Technologists (India) at the Bangalore Press, Bangalore - 560 018. Views expressed in the columns of the Indian Food Industry are not necessarily those of AFST(I).

Correspondence : All correspondence related to editorial matter, subscriptions and advertising should be addressed to

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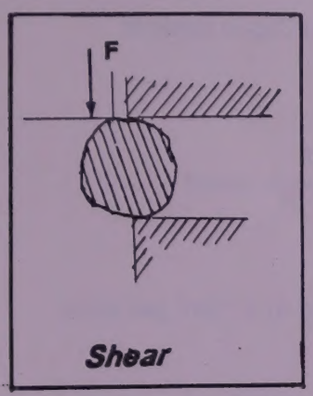

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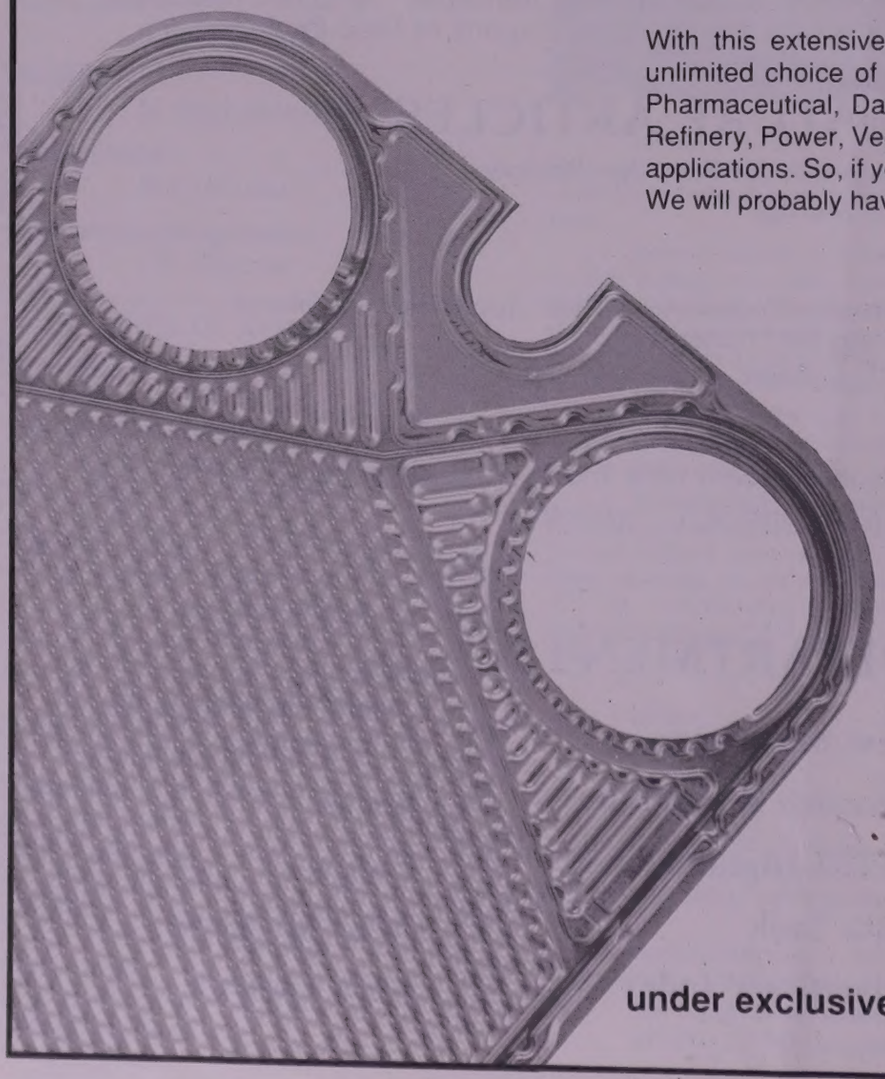

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EDITORIAL

The liberalization of economy and its restructuring for globalization has in its wake brought many perceptible changes in outlook and programmes in almost every sphere of endeavour. The euphoria and the fear of the past four years have now yielded place to pragmatism. The technological on slaught coupled with the massive fiscal strength of the transnational organization had become a matter of great concern, generating fear and awe in both the indigenous industry and the science and technology community. While the resource crunch continues to haunt the scientific community, it still holds the fort and even seems to be emerging out of the clouds. The congregations in every field of scientific discipline now deliberate on the current challenges and exude a sense of confidence in themselves.

Most assemblies of scientific and technical communities now deliberate on the societal and market-oriented goals and are in the forefront in seeking resources to accomplish this end. This trend can have far reaching implications, unless guided by well laid S&T policy at the apex level. The S&T policy it is hoped, will not compromise on the strategic research with long term objectives and excellence in frontier areas of knowledge, since only good science can give good technology.

On the part of industry also, long term investment in generating fundamental understanding and strength in the chosen spheres of activity is just not a necessity, but essential for competition and survival. The conferences of industry and scientific committees provide golden opportunities to endeavour towards these goals of excellence in science and technology.

In this context, the coming CAC meet organized by CFTRI, is a well thought move to provide a stimulating experience for the food industrialists to cash on the 45 years of R&D efforts of CFTRI's Food scientists and Technologists .

S.P. Pillai
Chief Editor

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INDUSTRY NEWS

Kerala Plans to Market Tender Coconut Water in North

The Kerala Government plans to market tender coconut water in tetrapacks in northern States, especially Himachal Pradesh.

The Minister for Food and Civil Supplies, Mr. Ramachandran Master, said this at the launch of blended juices in tetrapacks marketed by the Himachal Pradesh Horticultural Produce Marketing and Processing Corporation (HPMC).

The Himachal Pradesh Horticulture Minister Mr. Sathyaprakash Thakkur, said HPMC planned to set up a fruit juice extraction unit in Kerala as a joint venture.

Mr. Thakkur said HPMC would supply the fruit pulp for the extraction plant. It also planned to establish a cold storage in Kerala to preserve fresh fruit and juice.

HPMC Expansion Programme

HPMC had taken up the expansion of existing infrastructure of post-harvest management by introducing the latest technology at the plants and cool chain. Two pre-cooling units costing Rs. 20 lakhs, would be installed at Oddi and Patlikuhl in the fruit producing areas of Shimla and Kullu districts. Vehicles with refrigeration facilities would be procured at a cost of Rs. 30 lakhs to transport the fresh fruits.

The HPMC Managing Director, Mr. K. K. Gupta, said through the asceptic tetrapack system, blended juices based on apple juice and mixed with other fruit juices like mango, litchi, orange, pineapple, apricot, peach, ginger and plum would be introduced.

Khaitan Group to Set up Integrated Sugar Complex

The S. K. Khaitan group is embarking on an ambitious programme by setting up the largest integrated sugar complex in the country with downstream production units for paper, alcohol and cogeneration of power.

The largest 500 acre Indian integrated sugar complex is to be set up in three phases. The first will entail a Rs 110 crore investment in a 3,500 TCD sugar mill with an expandable capacity of 7.500 TCD, a 60 kilolitres capacity distillery and a power cogeneration unit.

In the second stage of implementation, another sugar mill is planned, with a capacity of 5,000 TCD, again expandable to 10,000 TCD at a total investment of Rs 125 crores. The power generation capacity is also to be hiked during this phase.

The final phase involves a Rs. 760 crore, 300 tonne per day capacity paper mill to be set up at the same location.

Paam Eatables Ties up with Austrian and German Companies

Paam Eatables Ltd, a Paam group company, has entered into two independent tie-ups with Natex Prozesstechnologie of Austria and Safety Handels Gmbh of Germany for setting up 100 per cent Export Oriented Units (EOU). It recently signed MOUs with both the companies.

The company has received approval from the government for setting up the EOUs as well as permission for entering into collaboration with foreign companies.

The Chairman of the Paam group, told pressmen that the company had tied-up with Natex to set up a 100 per cent export oriented spices oil, oleoresin and herbal extraction project.

The plant and machinery will be supplied and set up by Natex. With the German company, Paam Eatables has entered into a joint venture for the manufacture of fruit juice concentrates. The unit proposes to produce fruit juice concentrates of pineapple, banana, orange and other seasonal fruits.

The annual capacity of the plant will be around 560 MT per annum.

According to the Chairman, the cost of the two projects would be Rs. 18.97 crores. The company plans to finance the project through

promoters equity of Rs. 4.77 crores, public issue of Rs. 6.2 crores and foreign currency loans of Rs. 8 crores from foreign financial institutions.

Natex is taking part in the equity capital to the extent of Rs. 45 lakhs and Safety Handels will take part in the equity capital to the extent of Rs. 32.33 lakhs.

Both the foreign companies will provide equipment and technological know-how for their respective projects and they have also entered into a 100 percent buy back agreement with Paam Eatables.

Mr. Bhargava said that an EOU in the agro sector was allowed to sell 50 per cent of its produce in the Domestic Tariff Area (DTA). The company planned to market its fruit juice concentrates in India, he stated.

Mr. Bhargava further added that the unit would be located at Alwar in Rajasthan.

The company planned to commence construction, this year and commercial production would begin by August, 1996.

UB Ties up with South African Sorghum Beer Co. (NSB)

United Breweries Ltd (UB), has signed a memorandum of understanding (MoU) for a joint venture with National Sorghum Breweries Ltd. (NSB) of South Africa, the largest producer of sorghum beer in that country.

Sorghum beer, which is brewed like lager beer, is opaque in appearance, highly nutritious and very popular among black South Africans, says UB.

Under the terms of the agreement, UB will invest 70 million South African bands (Rs. 60.40 crores) for 30 per cent of the equity capital in NSB. UB has the option to increase its shareholding to 50 per cent in due course.

UB will play a significant role in the management of NSB and will also undertake the training of NSB employees at its various plants.

UB will also license NSB for the production of UB beer brands such as Kingfisher and Lager. This will be produced and marketed at NSB's lager beer unit, which currently produces and sells lager beer under the brand name 'Vivo'.

Mr. Vijay Mallya, Chairman, UB Group, said : "This is a wonderful opportunity towards the effective globalisation of Indian industry. Financial benefits to both UB and NSB will be considerable and a deal of this magnitude bears fitting testimony to the close cooperation that is developing between India and South Africa."

According to UB, the deal between NSB and UB represents the largest Indian investment commitment into South Africa. Under the management exchange programme, Indian managers will be deputed to South Africa and black South African managers will be deputed to India and other UB locations worldwide. Under the MoU, UB will receive management fees from NSB as well as royalty towards licensing of the Kingfisher beer brand.

Package of Financial Aid for Meat Processing Industry Drawn up

The Government has drawn up a financial assistance programme to improve the hygiene and quality of meat products in the country. This was stated by the Minister of Food Processing, Mr. Tarun Gogoi, while addressing the members of a consultative committee attached to his ministry. An initial amount of Rs. 420 lakhs has already been provided for the scheme.

Stressing the need for high standards of hygiene, Mr. Gogoi said that the Government has introduced very strict regulatory norms. The Bureau of Standards has designed standards for the construction of slaughter houses, meat and meat products, livestock and farm machinery. Marketing federations have been started in Maharashtra, Andhra Pradesh, Tamil Nadu, Karnataka and Orissa to ensure the easy availability of hygienic meat and other poultry products.

Mr. Gogoi also said that the export of meat and poultry products has registered a 100 per cent increase during the last four years and has reached Rs. 345.7 crores during 1993-94 from Rs. 149.5 crores in 1991. This could be further improved by adopting efficient methods of packaging and transportation, as India is at an advantage when it comes to the export of meat products to countries in the Middle East and South East Asia. Mr. Gogoi said.

The Members of Parliament who attended the meeting complained about the inadequate hygiene standards in

meat-processing and suggested that the Government expedite the modernization of meat-processing plants.

Raidco to Set up Starch Factory in Kerala

The Regional Agro-Industries Development Corporation Kerala Ltd. (Raidco) will set up a factory to manufacture starch for industrial use, according to the Chairman, Mr. M. C. Jose,

Kollam district is being considered for locating the plant, he said.

A Rs. 10.5 lakh fruit processing unit would be set up at Mattannoor, near the existing processing unit. Central grant had been received for a fruit processing and training centre at Mattannoor.

Project reports for the proposed Rs. 16.62 crore chain of 15 fruit processing units had been prepared with financial assistance from the NCDC. The Rs. 65 lakh curry powder unit, proposed to be set up at Kasargode would be the first, and the groundwork had been initiated for this, according to Mr. Jose.

NHB to Assist Three Export Unit Projects

Five projects, including three 100 per cent export-oriented units (EOUs), have been cleared for the National Horticulture Board's (NHB) assistance, according to an NHB communication.

Deccan Florabase Ltd, a Rs. 7 crore 100 per cent EOU, producing 9.5 million cut roses per annum, will be given a Rs. 1 crore soft loan.

Neha International, another 100 per cent EOU, will also be given an NHB loan of Rs. 1 crore.

Zuari Foods and Farms (P) Ltd, also a 100 per cent EOU, for the production of 500 tonnes pa of oyster mushrooms, will be given a Rs. 40 lakh soft loan by the NHB.

The Horticultural Producers' Cooperative Marketing and Processing Society (Hopcoms), Bangalore, will be given a Rs. 30.7 lakh aid for setting up a cold storage unit, whose approximate cost is Rs 76.85 lakhs.

APEDA Exports Touch New Heights

The overall estimated agricultural exports through the Agricultural and Processed Foods Export Development Authority (APEDA) for 1994-95 touched Rs. 2,958.60 crores, as against Rs. 2,848.95 crores in 1993-94.

Similar to the pattern in the previous year, fruits and vegetables formed the major part of the exports, at Rs. 448 crores.

Fruit pulp, which lost markets after the disintegration of the USSR, a major buyer, is slowly building up again, as exports are on the rise to Russia and other CIS countries.

Canned gherkins, recently added to the export list, form a major part of vegetable exports. Their export shot up to Rs. 16.76 crores this year from Bangalore alone.

Bangalore is the major gherkin growing area, with six companies engaged in the business. Tuticorin and Madras also export gherkins to a small extent.

Spain is the largest importer of the vegetable, accounting for Rs. 4.43 crores of exports, though it is not the largest consumer. Other exotic vegetables such as broccoli are also being exported.

Fruit exports comprise fresh fruits as well as fruit pulp, jams, jellies, squashes and syrups. Though the overall mango pulp production has been static, its exports from Bangalore were good. This is despite last year's moderate harvest of the fruit. The southern region, particularly Bangalore, saw a decline in the alcoholic beverages segments, though national level exports have been steady. The increasingly lucrative domestic market upset the balance between domestic sales and exports.

Prohibition in Andhra Pradesh and Gujarat is likely to be reflected in the current year's export figures which will be compiled at the end of March 1996.

The major exporters of alcoholic beverages include the UB group, Shaw Wallace and Mohun Meakins. Beer is also being exported to the US and the UK. Animal products registered a significant growth from Rs. 374 crores in 1993-94 to Rs. 485 crores last year.

This is seen to be linked to the setting up of a committee by APEDA, the Ministry of Agriculture and the health and veterinary departments to approve of the slaughter houses in the country.

The bulk of exports under the 'animal products' category, is buffalo meat, which forms 70 per cent of the exports, fresh mutton and a small amount of poultry products.

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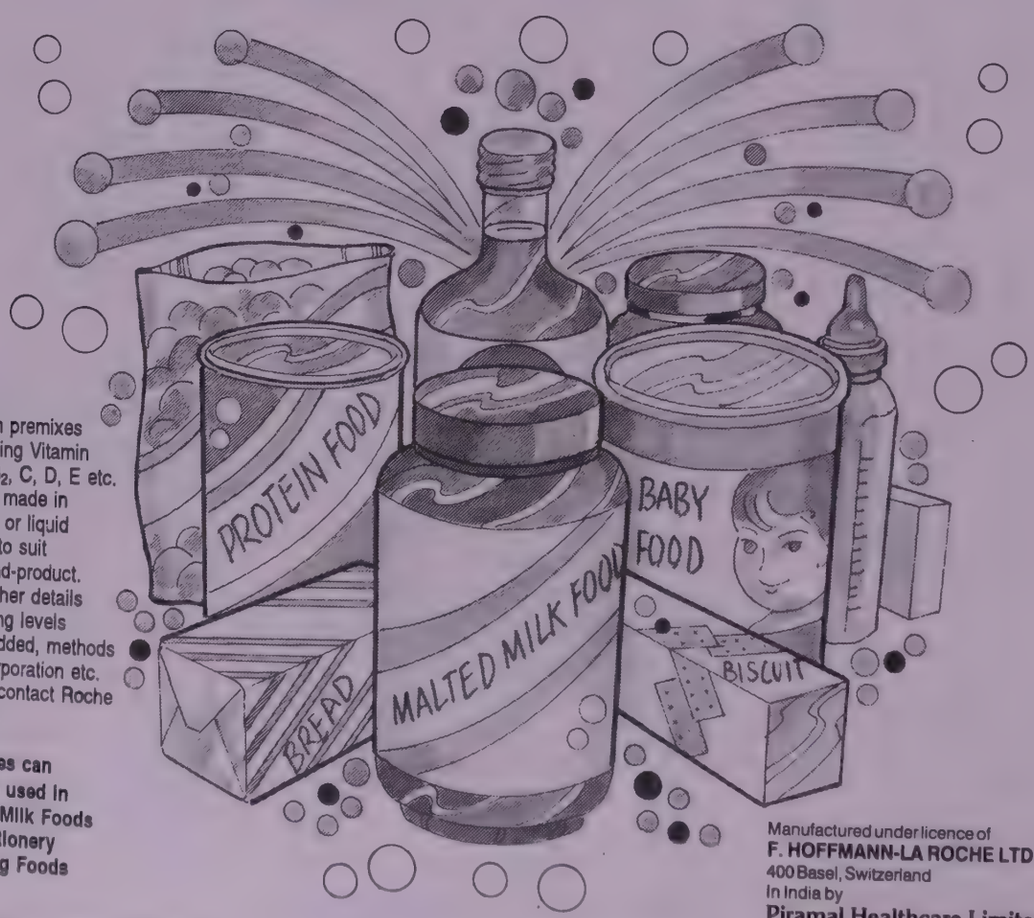

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Dairy products are also exported, though the exports are controlled by the Government.

Export of other processed foods including groundnut, sorghum, jaggery and confectionery are estimated at Rs. 416 crores. This has come down from the previous year's unprecedented Rs. 456.51 crores. Two kinds of confectionery, hardboiled sweets and traditional Indian sweets are exported from the country.

The former attract heavy duty in all importing countries because of their high sugar content and so only limited volumes are shipped.

On the other hand, Indian sweets such as *revadi, chikki,* and *burfi* are seen as having an enormous export potential for growth.

Indian Litchees to EC Market

For the first time, India has exported the juicy fruit, litchee to the European market.

Three consignments of litchees from Muzaffarpur in Bihar were exported to Britain, France and Holland by the Agricultural and Processed Food Products Export Development Authority (APEDA).

The authority has also been providing financial assistance to coldstorages to develop infrastructural facilities, so that the shelf-life of litchees increases.

Some corporate houses such as Godrej Agrovet have also been actively engaged in the export drive. Integrated pre-harvest and post-harvest programmes were conceived under which pre-cooling and coldstorage facilities were set up with APEDA's assistance.

According to reports received by the APEDA, the first consignment of litchees sent to France and England have reached the importers in excellent condition and fetched a very good price in the market.

Boxes of two kg litchees are sold in the wholesale market for 55 Francs (Rs.340) and 7.5 Sterling (Rs.375) in France and Britain, respectively.

The APEDA had been attempting for the past two years to export litchees from Muzaffarpur. Two Australian consultants were invited to standardize the post-harvest practices of litchees for export purpose.

Kavini Plans a Giant Dairy Unit

The Kavini group will soon set up a dairy production and processing unit. The total cost of the project is expected to be around Rs. 250 crores, according to the Chairman, Mr. Basu Bhuwalka.

The Chairman told newspersons that the company would soon market milk in Madras under its "Kavini" brand name. The supply would begin from October 2 this year.

Initially, about 50,000 - 60,000 litres would be marketed. Priced at Rs. 9 per litre, the milk would be supplied through sachets and vending, machines for bulk sales. Over 100 outlets were planned in the city, he said.

The main processing plant is expected to come up near Gudur, Andhra Pradesh. The capacity will be around 5 lakh litres per day. The processing plant may begin operations by September. The unit will also produce value-added products such as ghee, cheese and butter.

The production will be supported by about 100 production centres located within a 100 kilometre radius of the main processing plant. Each of the production centres will have 500 animals. These centres would have the required feed and medical facilities.

MacDonald Martin JV with Mohan Meakins

MacDonald Martin, the second largest whisky producer in the world, has entered the Indian market through its 50:50 joint venture with the Mohan Meakins group.

According to MacDonald group Marketing Director Alex Nicol, his group has established a joint venture plant at Mohan Nagar to take advantage of liberalised Indian economy.

The MacDonald Mohan Distillers Ltd (MMDL) with an equity capital of Rs. 12 crores would not only cater to the growing Indian made foreign liquor (IMFL) market, but also be used for sourcing exports to the neighbouring and the Gulf countries.

Wimco to Set up Tomato Paste Unit

Wimco plans to set up the first tomato paste unit in South India at a cost of Rs. 40 crores. The plant will be set up at Hoskote near Bangalore.

The Rs. 180-crore company which is well known as a manufacturer of matches, also has a foods division with a turnover of Rs. 20 crores.

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The tomato paste will be used as inputs by the manufacturers of value-added products such as ketchup, jams and jellies.

Apart from the tomato paste plant, it also plans to go in for value-added products, export of fresh fruits and vegetables and frozen vegetables for both domestic and export market.

Alsa Marine to Expand

Alsa Marine and Harvests Ltd (AMHL) is expanding its seafood processing unit at a cost of Rs. 31.89 crores.

The expansion and modernization include setting up a modern R&D centre, a pre-processing facility and augmented utilities. The state-of-the-art plant in Madras will have a cooling plant, individual quick freezers and packing equipment.

The value-added products of the company include blanched, cooked and individually quick-frozen seafoods in small packets.

Godrej Foods Ties up with Grandmet Subsidiary

Godrej Foods Ltd has entered into a joint venture with the Pillsbury Company, a subsidiary of UK-based Grand Metropolitan Plc, for the manufacture and marketing of range of food products. Pillsbury will have the controlling interest in the joint venture.

The joint venture, to be called Godrej Pillsbury Ltd, will be with Godrej Foods Ltd, a listed company with headquarters in Bombay. In addition to interests in food products, the Godrej group has businesses that range from durables, such as domestic appliances, to consumer products, like soaps.

Pillsbury plans to begin this initiative with the introduction of basic branded foods such as mixes. "This is an important next step in our efforts to compete even more effectively in the international market place", said Paul S. Walsh, CEO of Pillsbury. "The India initiative complements what we have put in place over the last few years in such countries as Mexico and South Africa, and provides us with a platform for further development in other countries. We can begin developing a mainstream food business in India and introduce our core brands".

"This is a major step towards increasing Godrej's presence in the rapidly-growing market for branded food products in India", said Adi Godrej, Chairman, Godrej.

The entry of Pillsbury into India provides a platform for brand building, company officials said. The joint venture will establish sales and distribution of infrastructure in cooperation with Godrej Foods to permit immediate access to major markets.

Pillsbury produces a range of grocery items, frozen foods and refrigerated dough products for international consumer markets. The company is also a major supplier of baking and other food products, to the US food service and commercial baking industries. The company's portfolio of market-leading brands includes Pillsbury. Green Giant, Old FJ Paso, Progresso, Hungry jack, Martha White, Downyflake, Pet Ritz, Jeno's Totino's Pappalo's, Haagen-Dazs and others. Other US subsidiaries of Grand Met include Burger King, Carillon Importers, Heublein, the Paddington Corporation, and Pearle Inc.

Godrej Foods has been looking out for a tie-up with a multinational for a long time. It recently entered into a marketing tie-up with Blue Diamond Almonds Growers' Co-operative. For its foods division, it has been negotiating with Heinz, Kellogg's and several other international brands. "The joint venture will also try to establish food brands according to Indian taste and palate", Adi Godrej had told a few months ago. The brand reputation and distribution network enjoyed by the Godrej group will be a big asset for the joint venture, feels Godrej.

Pillsbury's refrigerated dough products are the market leaders in the US with a 75 per cent share. The highly successful Grands biscuits achieved the number one spot in the speciality biscuit category with over $100 million in annual sales.

This will be the second entry of the Grand Met group in India. Its subsidiary IDV set up a joint venture with Polychem last year.

Two New Export Oriented Units

The first one is the Visakha Orient Exports Ltd is a 100 per cent EOU., exporting fresh fruit and vegetables to Sharjah, Singapore, Australia, Britain and other countries.

The project is sponsored by the APEDA, and financed by

the SBI Overseas Branch, Visakhapatnam.

The plant, having a 15 tonne pre-cooling capacity and a storage capacity of 70 tonnes, is situated about 100 km from Visakhapatnam, giving it easy access to port facilities. The cold storage is from Voltas and the air handlers are imported from co- ordinated Thermal Systems Pty Ltd of Melbourne, Australia.

The company hopes to tap into the Japanese and U.S. markets and believes that by developing cool chain systems in India, domestic prices of farm produce can be stabilized. The company is planning to supply domestic consumers directly by grading and packing the produce. It is planning a marketing tie-up with a major food processing company. The company also plans to manufacture mango jelly and aroma in a fully automated plant.

The second is the Classic Mushrooms Limited, a 100% Export Oriented Unit promoted by a NRI and MMTC has complete collaboration like technical, financial and 100% buy back with Galil Engineering, Israel and A.V.I. of Hong Kong.

Classic Mushrooms is planning for just 2300 tonnes of exports is to be based near the port city of Visakhapatnam.

The Branded Pulse

For the first time in the country, pulses are being branded. Satnam Overseas has launched a premium range of pulses under the brand name 'Super Kohinoor Pulses'.

Twenty one pulses will be available in laminated packs of 1 kg. They are already available in Bangalore and other leading towns of Karnataka. They have been launched in Bombay now.

The pulses are 15 per cent more expensive than the pulses available at the grocer's shop. The prices will vary according to procurement prices.

Satnam is planning to distribute the pulses countrywide and has set up an extensive distribution network.

Domino's Pizza's Foray into Indian Market

Domino's Pizza, the $2.2 billion Michigan-based fast food major has shortlisted Cadbury Schweppes for setting up its fast food joints in the country.

After Kentucky Fried Chicken and Pizza Hut - both part of the Pepsi Co and McDonald are exploring the lucrative Indian fast food market.

Domino's Pizza started operations with the delivery of plain hot pizza followed by garden salads, submarine sandwiches, twisty bread and buffalo wings in the recent years.

However, Domino's Pizza's competitors, Pizza Hut and McDonald's will be investing around Rs.248 crores and Rs. 124 crores, respectively in the Indian market in the first seven years to operate 30 restaurants and about 100 outlets.

With the three fast food giants entering the Indian market through possible marketing tie-ups with soft drinks majors, competition in the fast foods industry will be tough.

This will also act as a precursor to some aggressive advertising and marketing strategies, vital to survive in the cut-throat competition among the multinationals.

Cadbury Schweppes, is gearing up to rope in few more non-cola drinks like Dr. Pepper in India.

Besides Dr. Pepper, A&W Root Beer, lemon drinks like Squirt and Jini, and the tomato juice drink- Motts, are the some of the non-cola drinks that Cadbury Schweppes is planning to launch in India.

Speciality Foods

Speciality Foods was set up in January 1993 with a view to market marine products for export.

The company has acquired a name in the processing and production of marine products.

The company has production facilities at Kakinada that is equipped to handle 10 tonnes of freezing per day and has 120 tonnes of storage capacity. An expansion programme has seen the acquisition of two factories - one in Visakhapatnam and the other in Cochin.

The company has marketing and finance tie-ups with Britannia Industries Ltd., MMTC Ltd., and Shaw Wallace etc., The company plans to move into the field of mushroom.

Technology Bureau for Small Enterprises Set up

- Asian Pacific Centre for Transfer of Technology (APCTT) in collaboration with Small Industries Development Bank of

India (SIDBI) has set up Technology Bureau for Small Enterprises (TBSE).

Range of Services

Technology Information : The Bureau has a large computerized data base on technology options available in the Asia- Pacific region. It gives the user valuable information on sources of technologies and means of accessing them.

Match Making : TBSE identifies business partners willing to collaborate; brings them face to face and extends support to tie up financial assistance and other requirements for joint ventures.

Finance Syndication : Depending on the cost of project, nature and quantum of assistance required, the Bureau undertakes financial syndication covering term loans, foreign currency; venture capital, lines of credit; equity assistance; and bills finance. The financial requirements of SMEs from other countries could also be arranged through development financing institutions (DFIs) of the respective country.

Export Promotion : The Bureau offers support for the export of technologies as well as SSI projects and the products manufactured by them as a part of the package, and arranges assistance through SIDBI and other DFIs apart from commercial banks.

Support Services : TBSE provides consultancy services to encourage product excellence; arranges buyer-seller meets on a regular basis for specific product groups; undertakes technology appraisal; and documents latest developments in the areas of technology, processes, export patterns; market opportunities, etc.

For more details contact :
The Chief,
Technology Bureau for Small Enterprises, APCTT
Building, Adjoining Technology Bhavan,
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Great Help for Women Entrepreneurs in Food Processing Units

The Ministry of the Food Processing has assured women entrepreneurs of complete government support and encouragement in the food processing industry which was poised for a great take-off.

Addressing women entrepreneurs, the Minister of Food Processing Industries, Mr. Tarun Gogoi said the sector had vast potential for expansion, and was also a very large employer and accounted for 19 per cent of the country's labour force and 18 per cent of the industrial GDP.

This, he explained, was an indication that the food processing industry had the capacity of generating employment and value addition on a large scale.

Welcoming the entry of foreign investment, the Minister said it would accelerate the pace of progress and development. The government was keen and willing to provide all support to the industry in its quest for quality and excellence, thereby enabling the productivity of the industry to grow and flourish.

Instant Tea from Brooke Bond

Brooke Bond Lipton India Ltd is setting up a 100 per cent export-oriented unit at Etah in Uttar Pradesh.

The EOU, which will have an initial capacity of 650 tonnes, will be commissioned by October this year and is expected to export around Rs. 20 crores worth of instant tea powder.

The BBLIL intends to enter processed food business soon in a big way.

The company has finalized a skill-based alliance with Pepsi Foods to acquire its tomato processing assets at Zahura in Punjab. The company's Vice-chairman and Managing Director, Mr. Gopalakrishnan said that tomato products, frozen desserts/ice creams and bread spreads will be the areas of focus in the future.

Sara Fund - A Brief Profile

To encourage entrepreneurial activity across the country, Creditcapital Venture Fund (CVF), in 1993, in tandem with Government of India's liberalized economic policies, took the initiative of setting up a mother or an Apex Venture Capital Fund called the South Asian Regional Apex Fund (SARA Fund), which, in turn, was envisaged to invest in State Venture Capital Funds (SVCFs) thus bringing finance closer to the industrial heartland. The 15 contributors, as detailed below, are renowned international and national financial institutions :

Contributors to the SARA Fund :

(Rs. in crores)

International Finance Corporation, Washington	25
Overseas Economic Corporation Fund of Japan	25
Asian Development Bank, Manila	15
Abu Dhabi Investment Company, Abu Dhabi	10
NIF Management Pvt Ltd., Singapore (Asia Pacific Venture Limited - II)	3
Industrial Development Bank of India	10
Creditcapital Venture Fund (I) Ltd.	12
Total Fund Corpus	100

This fund is mandated to help set up ten SVCFs, with active collaboration of SIDCs/SFCs. Each SVCF is a closed end fund of 12 years and will have, on an average, a fund corpus of Rs. 20 crores with SARA fund contributing 50% in each of them - the remaining coming from SIDCs, industry, banks etc.

Each investment made out of SVCF, on an average, will be locked in for a period of 3-4 years and with at least three rollovers at 30% of the promoters equity in each investment, the catalyzing effect of this fund will be Rs. 800 crores worth of investment in the state in its lifetime.

Both, SARA Fund and the SVCFs, will be managed by Creditcapital Venture Fund (I) Ltd. (CVF).

A Written application from the entrepreneur stating the amount of assistance required along with a detailed Project Report is enough to initiate the process.

Potential of Goat Milk ..... *Continued from page 46*

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Assistance Schemes of Ministry for Food Processing Industries

A. Fruit & Vegetable Processing

Name of Scheme	Activity proposed to be assisted	To whom	Pattern of Assistance	Gant-in-aid/ Equity
(1)	(2)	(3)	(4)	(5)
1. Scheme for setting up food processing and training centres in the rural areas.	(a) Setting up FPTC & Integrated Training Centres	Cooperatives, Autonomous bodies, Govt. agencies or voluntary organizations.	(a) Upto Rs. 2 lakhs for FPTC for plant & machinery and maximum Rs. 1 lakh training	Grant
	(b) Commercial production by FPTC.		(b) grant upto maximum of Rs. 1 lakh per FPTC.	
2. Scheme for assistance for establishment of F &VP units	Setting up F &VP units	i) State Govt. undertakings ; Central Govt. undertaking Cooperatives	i) Upto 50% of non-recurring cost (60%) in industrially backward districts 75% in ITDP, NE & Hilly States.	Equity
		ii) Voluntary agencies & autonomous bodies	ii) -do-	Grant
		iii) Assisted/Private sector set up in rural area.	iii) Upto 15% of equity capital subject to ceiling of Rs. 15 lakhs per applicant/unit.	Equity
		iv) Joint Sector (with State Govt.)	iv) Upto 50% of the amount required to be paid by the State Govt. undertaking.	Equity
3. Scheme for strengthening backward linkages between processors and growers Testing Centres.	Backward linkage-contract farming	State undertakings cooperatives, joint sector enterprises, & Private sector enterprises	- Contracts with at least 25 farmers - Upto 5% of purchase price - subject to ceiling of Rs. 10 lakhs for new undertaking upto 50% of cost of extension subject to ceiling of Rs.5 lakhs.	Grant
4. Scheme for assistance for development of infrastructure for mushroom cultivation and processing	(a) Infrastructure for mushroom - Setting up spawn labs, compost pasteurization facilities & processing facilities.	i) Central/State sector undertaking cooperatives, joint sector, autonomous/ voluntary agency	i) Upto 50% of capital cost of setting up chambers	Grant
		ii) Private sector & Assisted sector	ii) On loans for plant & upto 50% of the interest liability subject to max. Rs.2 lakhs.	Grant
	b) Advertisements for marketing of mushrooms	Any organization	b) Upto 50% of cost of promotion subject to maximum Rs. 2 lakhs.	Grant
5. Assistance for development and processing of Hops	Development of Hops	a) Public sector/Joint sectors/ Cooperative/autonomous undertakings	On case to case basis as lump sum grant	Grant
		b) Farmers	Upto 50% of cost of procurement of some material	Grant
			lump sum grant	Grant
6. Generic advertising on processed foods and for providing marketing assistance.	a) Promotion of FPO symbol	Professional agency		
	b) Production of literature, cost of advertisement, remuneration of professional mktg. personnel.	i) Central/State Govt. undertaking/Coop./autonomous bodies/associations of industry/voluntary agencies.	i) 50% of fruit year's cost upto Rs. 10 lakhs/organization	Grant
		ii) Joint sector Central/State Govt. undertaking/joint sector org./Coop/org. pvt. sector	ii) 25% of first year's cost upto Rs.10 lakhs/org.	Grant
	c) Buying produce from small units and marketing under ownbrand name		50% of cost of marketing promotion, upto Rs. 10 lakhs for upto 2 years (if it makes contract with at least 20 units for 5 years for 50% of small units production capacity)	Grant
	c) Quality control labs	Any Organization/Institute	Upto the capital expenditure for setting up the lab.	Grant
7. R&D in F&VP	Research in identifying potential varieties & package of practices extension efforts R&D on packaging	Scientific/Technical/Other Organization	On case to case basis	Grant

Assistance Schemes ..... Continued on next page

B. FISHERIES

Name of Scheme	Activity proposed to be assisted	To whom	Pattern of Assistance	Grant-in-aid/ Equity
(1)	(2)	(3)	(4)	(5)
1. Assistance for participation in deep sea fishing and processing	Assisted to MPEDA to enable them to extend their scheme for equity participation in deep sea fishing & on-board processing ventures.	MOPEDA/NMFDB	Lump sum grant	Grant
2. Grant-in-aid providing interest subsidy on loan for acquisition of deep sea fishing vessel.	Reduce interest on loans given by SCICI	SCICI/NMFDB	Lump sum grant	Grant
3. Assistance for diversified fishing	Modification of vessels for diversification of operations.	MPEDA/NMFDB	Upto 30% of cost of modification (Ceiling Rs. 5 lakhs per vessel)	Grant
4. Scheme for effective implementation of MZI Act by providing funds for installation of communication facilities for the Coast Guard.	Installation of communication facilities by Coast Guard	Coast Guard	Lump sum grant	Grant
5. Scheme for setting up of cold-chain.	Infrastructure development - freezing plants, cold storages, refrigerated transport etc.	Central/State Govt. Organisation/undertakings/Coop. Federations/Associations of Industry.	Upto 50% of capital expenditure on establishment of the facilities.	Grant
6. Scheme for tuna and other fish processing.	a) Setting up modern tuna, shrimp and other fish proceessing facilities & instal sophisticated machinery.	a) Public sector/Joint sector/ State level corporatives.	Upto 50% of capital cost of project.	Grant
	b) Assistance to MPEDA to enable them to extend their scheme of subsidy to the private sector for acquisition of processing machinery.	b) MPEDA	Grant to MPEDA	Grant
7. Assistance to National Marine Fisheries Development Board.	Setting up of Board-establishment cost	NMFD Board	Lump sum grant	Grant
8. fishery Survey of India	F.S.I.	Fishery Survey of India	Lump sum grant	Grant

Source :Compendium of Special Schemes for Development of Food Processing Industries.

All India Food Preservation's Association
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New Delhi - 110 016

APEDA's Assistance Programmes for Promoting Exports of Food Products

Sl. No.	title of Scheme	Activity components under the Scheme	Pattern of Assistance
1.	Scheme for survey feasibility consultancy and data base	a) Development of data base on products. Infrastructure and services	Undertaken by APEDA
		b) Assistance to growers, their organizations and Associations, Exporters, Entrepreneurs etc. for feasibility studies	30% (ceiling of Rs. lakh per beneficiary)
		c) Assistance to growers their organizations Associations,Exporters for preparation of product literature publicity material etc.	i) Product and publicity literature : 40% ii) Audio-visuals 40% ceiling of Rs. 1 lakh per beneficiary)
2.	Scheme for development infrastructure and services	a) Assistance for purchase of specialized transport units for meat horticulture and floriculture sectors	25% (ceiling of Rs. 1.5 lakh per unit)
3	Scheme for assistance for modernization/upgradation/ expansion-diversification	a) Financial Assistance for modernization and upgradation of slaughter houses/processing plants under the public sector engaged export production	505 of modernism upgradation costs
4.	Scheme for export promotion and market development	a) Supply of material for purposes of product information, publicity and promotion by APEDA	cost of samples or freight or both to be decided on cases to case basis (ceiling of Rs. 50,000/- per exporter)
		b) Brand publicity	40% (ceiling of Rs.50,000/- per exporter)
5.	Scheme for brand promotion	Interest free loan	40% of the expenditure (ceiling of Rs. 50,000/- per beneficiary)
6.	Scheme for packaging development	a) Programme development packaging standards and designs	APEDA's own programme
		b) Assistance to exporters for packaging development	60% subsidy on cost of packaging developing (ceiling of Rs. 1 lakh per beneficiary)
		c) 30% subsidy to exporters for utilizing packaging developed by APEDA through IIP or others	30% subsidy (ceiling of Rs. 1lakh per beneficiary)
6.	Subsidy for acquisition of machinery and equipment for production of IQF shrimp	To assist seafood processors to acquire machinery & equipment for production of IQF products	25% of the cost of the IQF machinery & equipment subject to a maximum of Rs. 15 lakhs.
7.	Subsidized distribution, of insulated fish boxes	For proper preservation of raw material (In iced condition) on board fishing vessel, in Shrimp farms, Peeling sheds and during transport	A moulded synthetic insulated fish box of 50 Lit. capacity is proposed to be distributed at 25% subsidy including perforated sheet to shrimp farmers (4 nos.) machanised fishing boats (4 Nos.) peelings sheds (6 nos.) processing plants (8 nos.) registered with the authority. 2 boxes to fishermen registered with fishermen societies/directorate of fisheries. Also 50/100 boxes to registered exporters for supplying to registered peeling sheds.

B. Promotion of Culture Fisheries

Scheme	Objective	Rate of Assistance	
Subsidy for new farm development	to bring new are under prawn farming	25% of the capital investment or Rs.30,000/- per ha. whichever is less subject to a maximum of Rs. 1,50,000/- for development of 10 ha. new area or more.	The scheme is being administered through the field offices established in the maritime States.
Subsidy for establishment of hatchery	To produce quality prawn seed through land based establishment for supporting prawn farming	Under the scheme subsidy assistance @ 15% subject to a maximum of Rs. 1.5 lakhs for private sector, 25% subject to a maximum of Rs. 2.5 lakhs for corporate sector and 50% subject to a maximum of Rs. 5.009 lakhs for Government sector is being extended	-do-
Subsidy on seed and feed	To step up production from the traditional culture area	Under the scheme subsidy assistance @ 25% of the cost of seed and feed or Rs. 450/- and Rs. 3,000/- per ha. whichever is less is provided for additional stocking and supplementary feeding. At this rate one individual or firm is eligible to get 150 ha. culture area.	-do-

Source : Compendium of special schemes' for development of Food Processing Industries.

All India Food Preserver's Association
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To be continued

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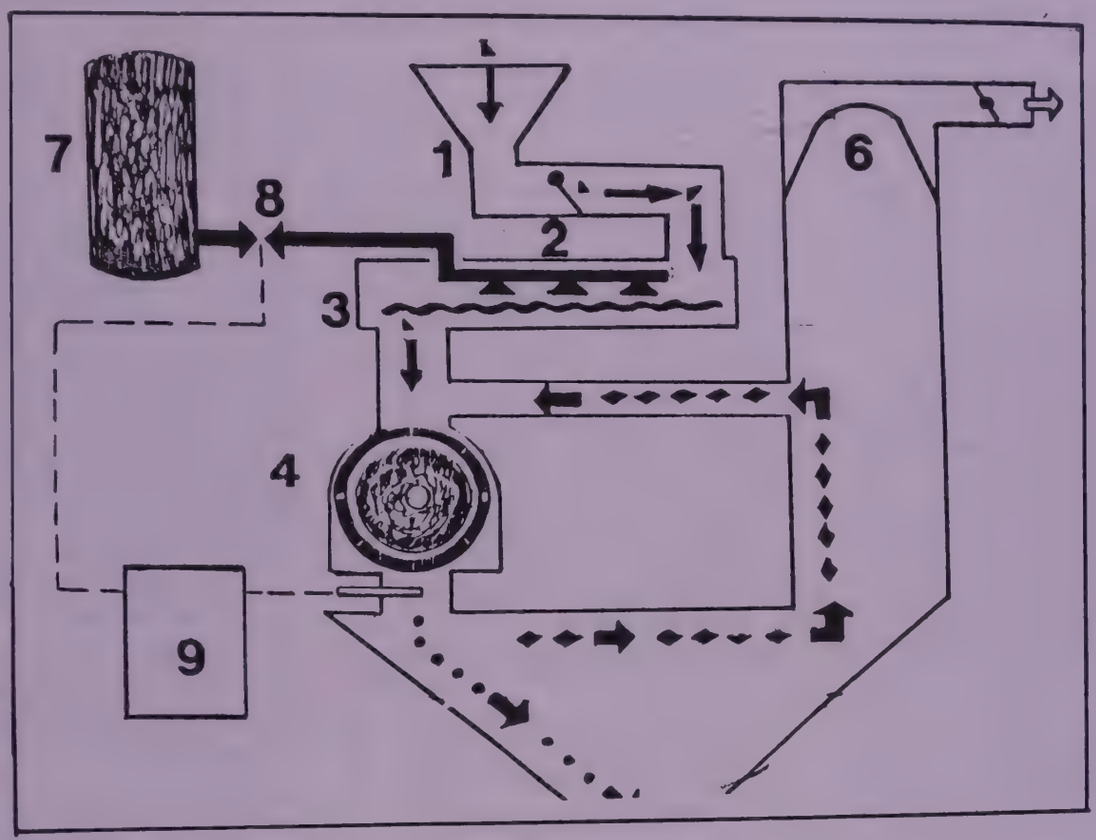
FEATURE ARTICLES



Cryogenics for Food Applications

Extrusion Cookers and Their Application in Oilseed Protein for Human Food

Potential of Goat Milk and Its Products as Health Food

Cryogenics for Food Applications

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Abstract

Conventional grinding of spices raises the temperature of the powder to as high as 95^{0}C, losing essential oils, leading to quality deterioration of heat sensitive spices. Latest techniques of cryogenic application for spice grinding and freezing improve the organoleptic properties of the processed foods. Cryogrinding of spices with fundamentals of size reduction, energy equations, equipments and advantages of cryogenics over conventional methods are discussed. Similarly, merits of cryo- freezing of fruits and vegetables and sea foods and cryo-freezing equipments are also discussed. Application of these techniques in the changed industrial scenario can boost Indian exports in processed spices and frozen foods.

Introduction

The major drive in the area of food processing and preservation is towards reducing the loss of organoleptic properties of foods during processing and preservation.

Food industry employs conventional grinders used in chemical industry for size reduction. Not much research is directed towards the development of specific grinders for food applications. These grinders have inherent disadvantages of high heat generation during grinding and low efficiency. This method of grinding is not suitable for heat sensitive, high fat content and fibrous materials. An alternative method is to freeze-grind the material under cryogenic conditions. The application of liquid nitrogen in grinding has been the much debated research area these days.

Similarly, freezing of commodities viz., seafoods, fruits and vegetables has become an another important area of research. There is a need to look into modern methods of freezing to make our produce enjoy a better impact internationally.

The major drive in the area of food processing and preservation is towards reducing the loss of organoleptic properties of foods during processing and preservation.

Though much research on cryo-grinding process and equipment has been done abroad, technology package is not available on spices. This technology is new to Indian food industry. Literature on grinding is rather scanty (Pruthi, 1991, McKee, *et al*, 1993, Gopalakrishnan, *et al*, 1991), and though much work has been reported on freezing (Gupta, 1992, George, 1993, Willhoft, 1987), they are of academic in nature. However research on cryo-grinding of spices at Central Cryogenic Facility, IISc, Bangalore, and on cryo-freezing of foods at IIT, Kharagpur, are being carried out.

The objective of this paper is to provide a comprehensive introduction to the cryogenic technology and its application in food industry. This paper deals with the latest cryogenic applications like cryo-grinding, and freezing, for export- oriented foods, using liquid nitrogen as cryogen. The fundamentals of size reduction mechanism, energy aspect and size reduction of spice have been discussed. This article also includes the current status of work at CFTRI, Mysore.

Definition of Cryogenics

The term "cryogenics ultra low temperature" is often used in an abstract sense. The range differs from standards of a country in particular. The national Bureau of Standards, UK, has defined cryogenic temperature as -150^{0}C and below. According to this definition, liquid nitrogen (Boiling Point [B.P.] -196^{0}C) would be in cryogenic range

whereas and carbon dioxide (B.P. -78^{0}C) would not be (Kim, and Hung, 1994). However, cryogenics is defined as a branch of engineering specializing in technical operations at very low temperature, about -160^{0}C to -50^{0}C (Parker, 1984).

Cryogenics is defined as a branch of engineering specializing in technical operations at very low temperature, about -160^{0}C to -50^{0}C.

Popular Cryogens

Cryogenic fluids or cryogens are those which boil at cryogenic temperature at atmospheric pressure. Many fluids, for example, hydrogen, helium, nitrogen, oxygen, inert gases, air, methane, carbon dioxide, etc., exhibit this property. Liquid nitrogen and carbon dioxide (liquid or solid) are the two major cryogens used for food application. Table 1 gives the thermophysical properties of these cryogens in comparison with Dichloro difluoro methane (Freon-12).

Size Reduction

Powders can be made in both non-mechanical and mechanical ways. But, conversion of a bulk solid to a powder commonly is a mechanical process, the most critical step being size reduction, or comminution. Lumps or large particles are subjected to contact forces, which deform the particles and generate internal stresses that, when strong enough, can bring about fractures or cracks. The number and direction of these fractures determine the size and the form of the fragments and the characteristic surfaces of the particles.

Many theories are available to explain how mechanical forces can cause individual particles to fracture. Brittle materials tend to deform elastically before developing cracks. Under a tensile stress, an elastic material elongates, then returns to its original shape when the stress is removed. If stretched beyond the elastic limit, it fractures. This characteristic makes brittle material fail suddenly when they are subjected to mechanical impact.

The theory of cracking in brittle materials, developed by, A.A. Griffith, focusses on how a chunk of material spends its energy budget. Griffith has noted that real solids are weaker than they might seem, because they contain microscopic flaws. A crack (or any flaw) in a brittle material reduces its tensile strength and leads to instability. If the material is subjected to sufficient stress, the built-up strain energy is expended rapidly in the creation of multiple failures (Cleef, 1993). Exposing the food materials to a cryogenic medium will cause internal stress build-up, due to fast freezing rate and this internal stress may lead to cracking or shattering. The cracking or shattering under such conditions could be due to volumetric changes associated with the water-ice phase transition and non-uniform contraction of empty spaces in microstructures following solidification (Kim and Hung, 1994). Food materials exposed to cryogenic temperatures become more brittle and crisp, and as such, grinding them is easier.

Exposing the food materials to a cryogenic medium will cause internal stress build-up, due to fast freezing rate and this internal stress may lead to cracking or shattering.

Table 1. Properties of food cryogens (Fellows, 1988)

	LN_2	CO_2	Freon-12
Density (kg m^{-3})	784	464	1485
Boiling point (^{0}C)	-196	-78.5	-29.8
Thermal conductivity (W m^{-1} K^{-1})	0.29	0.19	0.095
Specific heat capacity (liquid, kJ kg^{-1} K^{-1})	1.04	2.26	0.984
Latent heat of evaporation (kJ kg^{-1})	358	352	297
Total usable refrigeration effect (kJ kg^{-1})	690	565	287

Mechanism of Size Reduction

Size reduction can be achieved by different mechanisms and sometimes with combination of two or more as shown in Fig. 1. These mechanisms may be compression, cutting, impact, shear, rubbing, etc. Various commercial size reduction machines are available (Loncin and Merson 1979). Generally, different products require different size reduction mechanism depending on their characteristics. Table 2 shows grinders of different mechanisms with their peripheral speeds, with product example.

Energy for Size Reduction

Grinding is an energy intensive operation wherein almost 99% of the energy appears as heat resulting in high product and equipment temperatures (Loncin, and Merson 1979). Remaining only 1% of energy is useful in creating new surfaces. There is no general method for predicting the energy needed for size reduction. Elastic and plastic properties of a given food material often vary with moisture content and the distribution of water in the material. Further complications arise because these properties are often strongly anisotropic, the various layers or parts having extremely different mechanical resistances. Also, the properties of materials can vary with the rate at which the stress is applied. Some materials are plastic and ductile if the stress is applied slowly, but can be elastic or brittle if the stress is applied by impact.

The minimum work of distortion can be measured by placing a sample in tension (or compression) in a machine (such as an Instron testing machine) which simultaneously measures both the applied force (F) and the elongation ($\Delta 1$) up to the breaking point using

$$E = \int_0^{(\Delta 1)\,max} F * dl,$$

which gives the energy (E) needed for breaking the piece (Loncin and Merson 1979) ;

However, the following laws can be used for theoretical estimation of energy for grinding of solids (Loncin and Merson 1979) :

Kick's law :

$$E = k_1 \log (D_1/D_2)$$

Rittinger's law:

$$E = k_2 (1/D_2 - 1/D_1)$$

Bond's law :

$$E/Wi = (100/D_2)^{1/2} - (100/D_1)^{1/2}$$

where D_1, D_2 are the initial and final characteristic size of particles, k_1, k_2 are constants, Wi is the work index and E is the required grinding energy.

Importance of Spice Processing

The global spice trade is estimated at 4.5 million tonnes, worth US$ 1.4 billion in the international market (Anon, 1995). Though India is the largest producer of spices accounting for 60% of world production and 39% of total export, in terms of value, it secures only 9%. The reasons are that the country does not produce high quality spices that fetch good price and spices are exported raw without any value addition. Maximum value addition is done abroad before it reaches the end-user. Now that the prices are increasing, the country is bound to gain and as such, the emphasis is on quality and value addition. Value-added products such as ground spices, mixes, oleoresins, and spice oil extracts have vast industrial application and with improvement in processes, India should be able to improve its share in the world market.

Size Reduction of Spices

Grinding of spices is an important step in process, as it involves the loss of volatile oil and aroma present in them. Generally, spices are ground either for direct use or for making value-added products like oleoresins or oils from them. Usually, grinding facilitates the release of aroma/flavour principles and better uniform mixing with food materials. At the same time, the grinding of spices results in considerable loss of aroma as a result of heat generated (42 to 95^0C) during conventional grinding. Since spices are valued for their aroma and flavour, prevention of their losses assumes importance (Gopalakrishnan *et al*, 1991). In large scale grinders where continuous grinding is undertaken, gumming of grinder walls and sieves (Anon, 1962) results in frequent stopping of mill for cleaning works and reduces the grinding rate. Spices which are fibrous pose a problem while grinding, consuming enoromous energy.

Cryogenic Grinding of Spices

Grinding of spices in the presence of a cryogenic fluid is referred as cryogenic or cryo-grinding. The grinding of spices under cryogenic conditions causes less distortion in the natural composition than ambient grinding. In cryogenic grinding, evaporation of liquid nitrogen quickly chills both the spice and the grinder. Fibrous materials become brittle and crisp making size reduction easy. The use of liquid nitrogen usually results in a cubic particle with good product flow characteristics. Grinding in the inert atmosphere reduces the risk of fire hazards and dust explosion.

In general, grinding of spices at cryogenic conditions has the following advantages

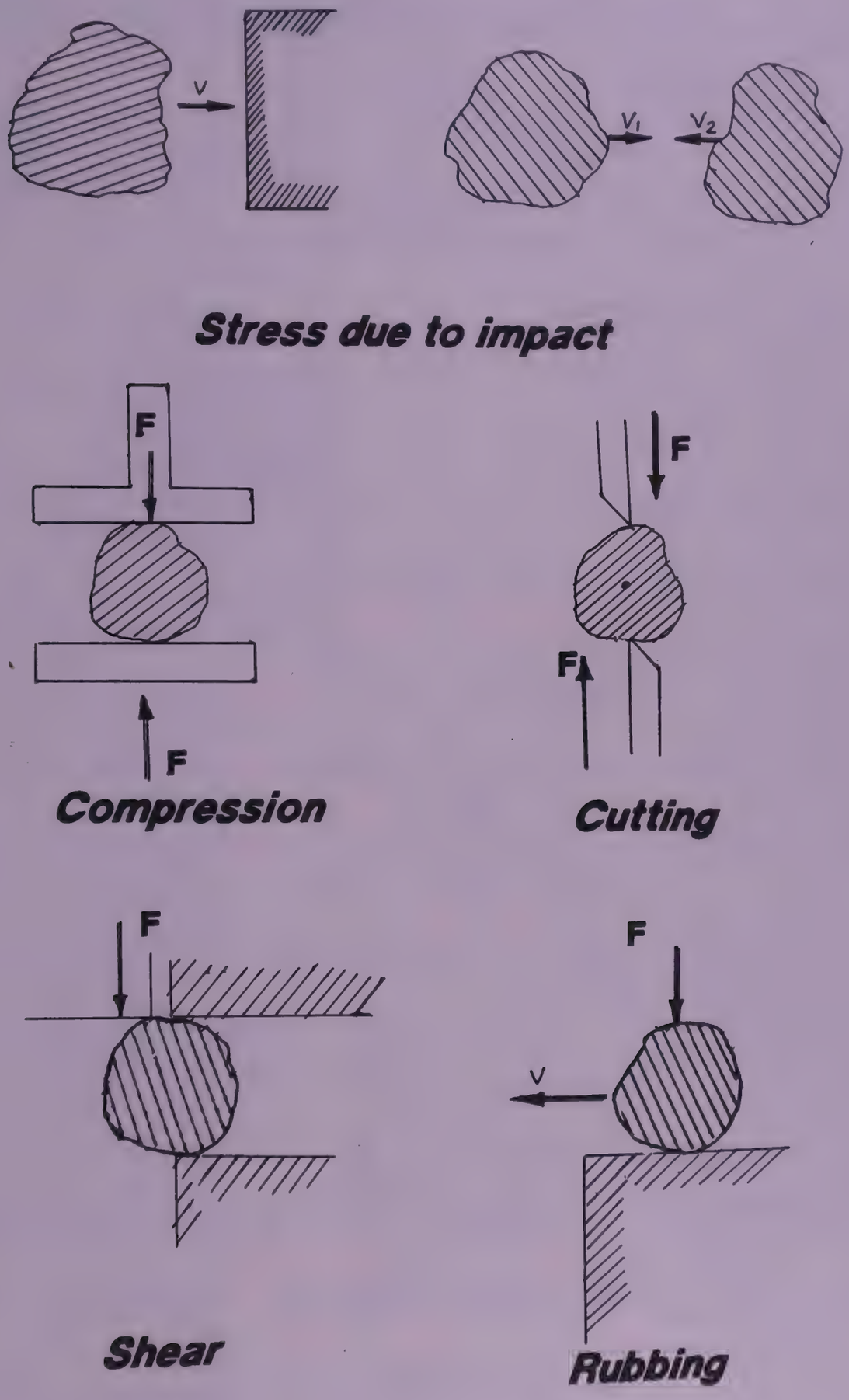

Fig 1. Stress Mechanism in Size Reduction (Loncin and Merson 1979)

Table 2. Types of grinders and their applications (Loncin and Merson 1979)

Name of the equipment	Method of size reduction	Peripheral speed (m/s)	Product examples
Pinned Disk Mill	Impact	80-160	Pepper, Nutmeg, Clove, Mustard, Roasted nuts, Sugar, Cocoa
Hammer Mill	Impact	40-50	Sugar agglomerate, Cocoa, Press cake, Tapioca, Dry vegetables, Extracted Bones
Blast Mill	Impact	40-110	Pepper, Pectin, Cocoa, Dry protein, Sugar
Ring Beater Mill	Impact and Shear	50-70	Pepper, Vegetables, Oil press cake, Pectin, Algae, Paprika
Disk Beater Mill	Impact and Shear	70-90	Common Cereal grains, Dry whey, Milk powder, Lactose
Hammer Cage Mill	Impact	70-90	Ginger, root & bark, Drugs, Tobacco leaves and stems
Toothed Disk Mill	Abrasion	5-16	Wheat, Pepper, Linseed, Fennel, Bitter orange, Rough grinding of rye corn, Junifer berries
Cutting Granulator	Section	5-18	Fish meal, Dried fruits and vegetable,s Frozen coffee extract, Cocoa press cake.

(Wistreich *et al*, 1962, Anon, 1962 ; Pruthi, 1991).

(1) Reduced oxidation of spice oils, as the LN_2 evaporates in the grinding zone, it tends to expel any air in the mill, and increased stability as cryo-treatment has a pasteurizing effect on the spices.

(2) Extremely fine grinding as spices become very brittle and spice oils solidify, resulting in more uniform dispersal of flavour, reduced visual speckling and reduced settling rate in liquid preparations.

(3) Reduced loss of volatiles, increased flavour strength. On an average, 30% increase in quality.

(4) Lowered microbial load as grinding is done at very low temperature and in inert atmosphere.

(5) Increased grinding rate because the grinder's cryo-temperature operation curbs "gumming up" of grinding surfaces and screens.

(6) Visually lighter in colour due to the absence of browning.

(7) Lower unit cost of powder when the flavour strength is taken into account.

A typical cryogenic grinding system is shown in Fig. 2. The spice is frozen by controlled injection of liquid nitrogen on a screw feeder. The liquid nitrogen frozen spices are fed to a universal mill through the screw conveyor. If required, liquid nitrogen may also be directly injected into the grinding zone. Instantaneous evaporation of liquid refrigerant quickly chills both the spice and the mill. It absorbs the frictional heat of grinding. By suitably adjusting the liquid nitrogen supply, it is possible to control the ground material temperature. This helps in grinding individual spices at the temperature which optimizes all the other parameters.

The grinding of spices under cryogenic conditions causes less distortion in the natural composition than ambient grinding.

Tables 3 and 4 bring out the difference between essential oil retention and the headspace analysis of different spice volatiles extracted from ambient and cryogenically ground spices, respectively (Pruthi, 1991). It can be seen from the Tables that the cryogenically ground spices retain more volatile component than the ambient ground samples.

McKee *et al*, (1993) have worked on nutmeg and reported that cryogenic grinding tends to produce ground nutmeg with more consistent results across batches than ambient or chilled grinding. Further, cryogenic grinding gave a higher percent-

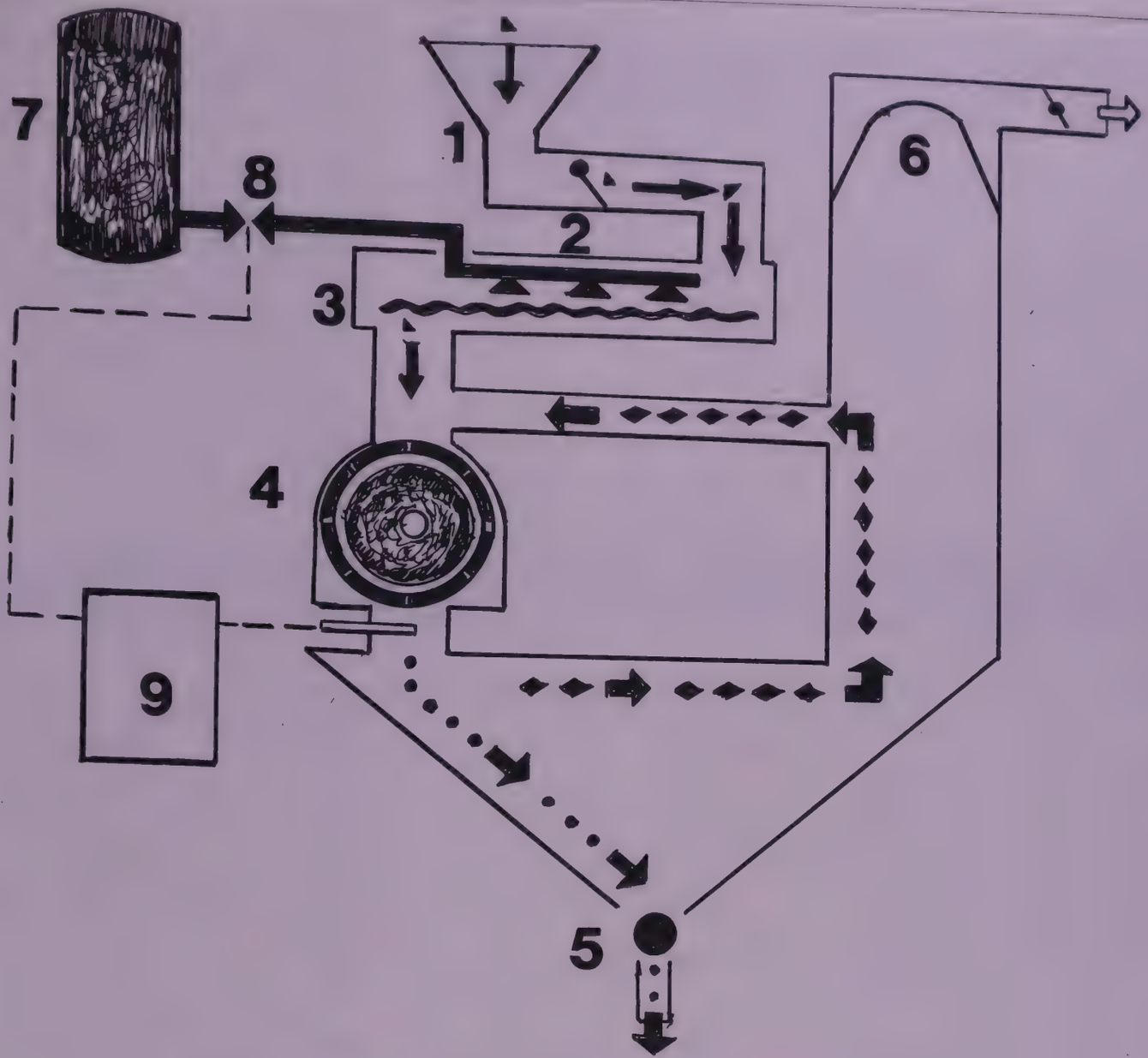

Fig 2. Cryo-Grinding System (Source : M/s Kemutec, UK)

Table 3. A comparison of the spice volatile oil retention by ambient and cryogenic grinding

Spice	Ambient grinding (ml/100g)	Cryo-grinding (ml/100g)	% increase due to cryo-grinding
White pepper	1.95	3.19	64
Black pepper	2.21	3.09	40
Pimento	2.71	3.08	14
Mace	9.10	14.50	59
Cloves	11.50	16.50	43

Source : M/s. Alpine, Germany

age of oleoresin and improved antioxidant property. Gopalakrishnan *et al*, (1991) have worked on cardamom and reported that cryogenic grinding provided superior quality product by preventing the loss of high volatile constituents during grinding.

There is a need to optimize the process parameters viz., the ground material temperature, type of grinder, rpm of the grinder, powder particle size, feed rate of the spice and coolant, type of cooling, etc., which give the best quality product at minimum cost. These conditions are product specific and depend on the physical characteristics of the spices.

Table 4. Gas chromatographic headspace analysis of different spice volatiles (Cryogenic Vs ambient grinding, Pruthi, 1991)

Spice	Component	Area (in integration units x 10^5) Grinding techniques Ambient	Cryogenic	% increase due to cryo-grinding
White pepper	α-Pinene	4.86	9.50	95.47
	β-Pinene	6.95	10.63	53.00
	Unidentified	9.64	13.36	38.59
	Limonene	5.59	6.76	21.93
Nutmeg	α-Pinene	16.75	19.38	15.70
	β-Pinene	8.84	9.34	5.67
Cinnamon	α-Pinene	1.15	8.32	623.48
	Camphene	0.40	2.53	532.50
	β-Pinene	0.45	2.42	437.78
	Cineole	0.11	0.47	327.27
	Limonene	0.24	0.54	125.00
Cumin	α-Pinene	0.24	0.42	75.00
	β-Pinene	3.23	4.49	39.00
	γ-Terpinene	1.24	1.39	12.10
Oregano	Unidentified	0.62	2.86	361.30
	α-Pinene	1.49	5.71	283.22
	Camphene	0.82	2.44	197.56
	β-Pinene	1.40	4.10	192.86
	Myrcene	0.00	3.98	Very high
	ρ-Cymene	8.32	17.31	108.05
	γ-Terpinene	4.92	12.87	16.59

PF 0.005 for all comparisons

Cryogenic Grinding of Other Food Materials

Cryogenic grinding is also applicable to a wide variety of food materials viz., cocoa and chocolate, vanilla-sugar, coconut, coffee, tea, dehydrated meats, etc. It has been found that there is a large gain in flavour when vanilla-sugar is fine-pulverized. The product has interesting possibilities and advantages as a replacement for liquid extract. Coconut can be ground to eliminate objectionable fibres, while improving its aroma and flavour as high fat content gets solidified and fibres become brittle. This offers applications in syrups, cakes, and confectionery. Ground cocoa and chocolate retain their natural flavour and aroma. Cryoground coffee appears to have longer lasting freshness of particular interest in instant-coffee processing (Wistreich *et al.* 1962).

Cryogenics for Freezing and Preservation

Importance of Freezing

Fruits and vegetables, spices and marine products have become important foreign exchange earners for the country. Indian marine product exports were a whopping Rs. 2,500 crores in 1993- 94, exporting mainly to Japan, USA, and UK. As the developed countries have a stringent quality specifications, using cryogenic technology makes our exports more competitive. In view of the government's intention of bringing about one lakh hectares of land under shrimp farming by 2000 A.D. (Anon, 1995), to enhance the production, the application of this latest technique is justified. Shrimp considered as the pink gold of the sea and export can be made further lucrative by value addition in the form of IQF packs.

Cryogenic Freezing

During the freezing of seafoods, fruits and vegetables and other food products, chemical and physical changes take place in the flesh of the product. Freezing causes the crystallization of most of the water present in the product. The formation of ice effects a concentration of solutes or dissolved substances in the liquid phase surrounding the individual cells. This increased concentration causes an osmotic imbalance, resulting in the transfer of fluids from cell to intra-cellular spaces, where it freezes to form ice. More water leaving the cell, larger are the ice crystals formed. Separation of the water from the cell continues until complete solidification of the product is attained. Therefore, the slower the product is frozen, the more complete is the movement of water out of the cell and conversely, the quicker the solidification point is reached, the more water is retained within the cell and the smaller are the intra-cellular spaces.

Different types of freezing systems using liquid nitrogen are on-line freezer, spiral freezer, immersion or dip freezer, and batch cabinet.

The degree of change that occurs during freezing is dependent upon the freezing time and the quality of the product before freezing. If the product is frozen slowly in an ordinary mechanical freezer, for example, it will be found that 'drip loss' is (as high as 10-15% for seafoods) more. Microscopic examination of frozen commodities shows a relatively small number of the smaller ice crystals, whereas rapid freezing demonstrated the formation of a large number of small crystals, and virtually no large injurious crystals. Rasmussen and Olson (1972) have reported for freezing of green beans that a cross section of a bean frozen with liquid nitrogen closely resembles the structure of a fresh bean, having little cellular damage as compared to slowly frozen bean in an air blast.

Many types of freezers are available viz., Cold store using still air as coolant ; Air blast freezer using forced air ; Plate freezer using contact to cold surface ; Fluidized-bed freezer using fluidizing air or liquid nitrogen as coolants.

Liquid nitrogen freezing and preservation have the following advantages ;

(1) Reduced bacteriological deterioration, as food spends minimum time in bacteriological damage zone of +5 to +60^{0}C, which retards the growth of disease producing organisms.

(2) Reduced oxidation, enzyme activity and metabolic deterioration, resulting in preservation of nutritional and vitamin properties.

(3) Better retention of original colour and texture leading to uniform, glazing and attractive product which can fetch maximum market value.

(4) Freezing times are very less i.e., 50% compared to other types of freezing

(5) Longer shelf-life.

(6) Lower capital outlay, low and easy maintenance than mechanical systems and higher productivity.

(7) Heat transfer coefficient is very high (2000-5000 W $m^{-2}K^{-1}$) when compared to conventional freezing (5 - 500 W $m^{-2}K^{-1}$).

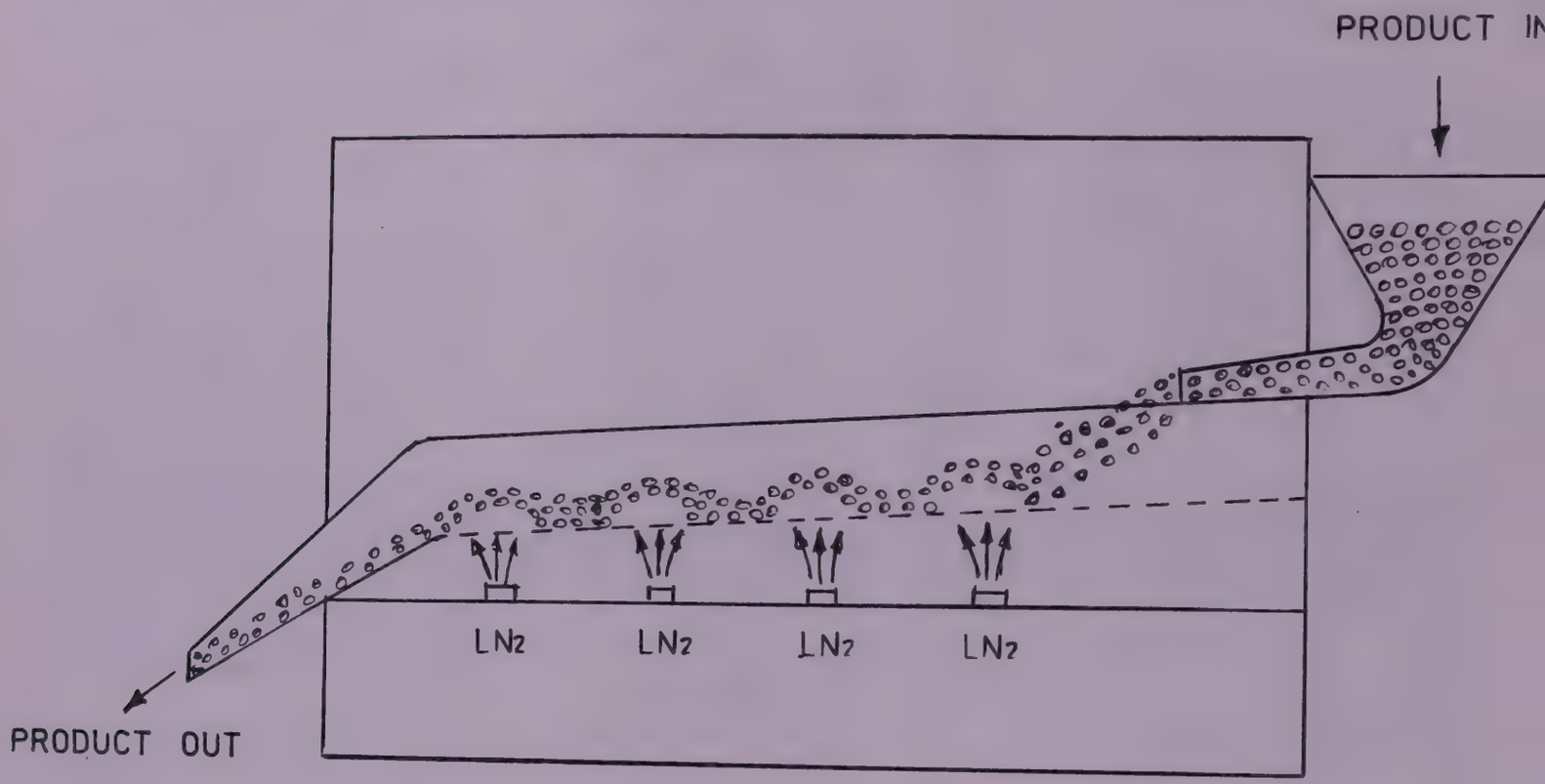

Fig 3. Fluidized-Bed Freezer

However, the unit operating cost of freezing seafoods, is higher in case of liquid nitrogen freezing systems as compared to mechanical refrigeration systems (Gupta, 1992). But, cryogenic freezing may be feasible for high cost foods such as seafoods.

Different types of freezing systems using liquid nitrogen are on-line freezer, spiral freezer, immersion or dip freezer, and batch cabinet. Both positive and negative features of these systems have been discussed by Wilhoft (1987). Fig 3 shows the fluidized bed freezer using LN_2 as cryogen (Reid and Stark 1974). This method has the advantage of uniform freezing, and ideal for foods of granular geometries, but not suitable for sticky and non-fluidizable materials.

The latest technique of freezing is "crusto freezing", or "cryo- mechanical system" wherein the liquid nitrogen is used for initial rapid freezing of the crust and the food is then frozen slowly in a mechanical system (George, 1993). This offers the advantages of both the systems-the flexibility and other benefits of cryo-freezing system together with the lower unit-cost factors of mechanical systems. This technique is more economical as existing mechanical systems need not be replaced.

Miscellaneous Applications

LN_2 in Packaging

Liquid nitrogen injection system can be used for both pressurization and inerting (Anon, 1990). In pressurization, a drop of liquid nitrogen is injected into a filled can just before sealing. When the nitrogen expands, the can gets pressurized, increasing its strength and stackability. In inerting, LN_2 is added to an empty container before filling. The nitrogen which expands to 700 times its original volume, displaces oxygen from the packaging, increasing the shelf life of the product. The system is useful for the packaging of oxygen-sensitive products such as coffee, sauces, olives and cooking oil.

LN_2 in Peeling of Fruits and Vegetables

Weaver *et al* (1980) reported LN_2 can be used for peeling of fruits and vegetables. In this method, tomatoes are immersed in liquid nitrogen for 5-15 seconds and then thawed in warm water to loosen the peel. Since this method involves no cooking, there is a removal of

only skin tissue with very small amounts of internal tomato pulp. Skin removal would be with a tissue loss of about 5-8%. This technique can also be applied for peeling of other fruits and vegetables.

LN_2 in Homogenization of Biological Tissue

Iyenger and Kasperek (1977) have introduced cryogenic homogenization (brittle fracture) technique for sample preparation of biological materials wherein the tissue is ground at near liquid nitrogen temperature in an oscillating ball mill of teflon. This method eliminates the risk of contamination.

Status of Technology in the Country

The machinery for cryo-grinding and cryo-freezing are not being manufactured in the country. Few companies abroad viz., M/s. Kemutec, United Kingdom and M/s. Hosakowa Alpine, Germany, can supply the system for cryo-grinding, and M/s. Ameron, USA can supply cryo-freezing machinery. The new technology is not available to food industry.

Scope at CFTRI

The work in the area of cryogenics for spices, coconut fibre grinding and freezing is being carried out at CFTRI, Mysore. The preliminary studies on grinding have given promising results in favour of cryogenic technology. In laboratory scale grinding of black pepper (Murthy, *et al*), there was a quantitative gain of 35% in the retention of volatile oil in case of cryo-grinding (ground powder temperature of -20^{0}C) as compared to conventional grinding (ground material temperature of 62^{0}C). The gas chromatographic analysis of volatile oil showed better retention of monoterpenes under cryo-grinding.

The cryogrinding facility (Hosakowa Alpine Make, Capacity 80 kg/hour), is being set up at CFTRI, Mysore for the R&D needs of spice industry and exporters.

Limitations of the Technique

Cryogenic technology has the following limitations ; (1) Liquid nitrogen has to be either produced or purchased for this purpose, (2) Operators are to be trained to store and handle liquid nitrogen, as it can cause severe cold burns, (3) Investment on imported machinery is high, but can be reduced by indigenous manufacture. However, the increased quality can pay for the extra investment made.

The cryo-grinding facility is being set up at CFTRI, Mysore for the R&D needs of spice industry and exporters.

Conclusion

Application of cryogenics in the Indian food industry is in its infancy. Presently, Indian exports in spices are mainly in whole form and processing is done in importing country. Adapting the latest techniques of spice processing for high quality powders and products makes our exports competitive in the international market. Feasibility of cryogenic technique for processing and preservation is to be established for large scale operations, under Indian conditions. This assumes importance in view of the growing exports of frozen seafoods from the country.

Acknowledgements

Author is thankful to Mr. H. Krishna Murty and Mr. M. N. Ramesh, Department of Food Engineering, CFTRI, Mysore, for their encouragement and help.

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Extrusion Cookers and Their Application in Oilseed Protein for Human Food

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Introduction

The extrusion cooker is finding application in so many diverse operations and it is being increasingly regarded as a versatile, high-temperature, short time (HTST) bioreactor. Cooking extruders have been generally accepted in food processing industry because of their versatility and ability to consistently produce a given product to a given set of pre-determined specifications. These machines offer many basic design advantages that enable them to be used for minimizing energy costs and processing costs.

Parts of the extruder

Main parts of the extruder are drive mechanism, feed happer, barrel, screw, die etc. are given in Fig.1.

The central part of a food extruder is the screw. Typical screw can be divided into three sections. The section of the screw, where the feed enters is commonly called the feed section and normally has deeper flights or flights of greater pitch. The section of the screw, where the feed material is compacted and converted from a flowing granular sticky mass to a relatively uniform plasticized dough is called the transition or compression section. After the material leaves the transition section and before it enters a die, a metering section of the screw with relatively shallow flights for increased restriction of the channel area is used to increase the temperature of the material for cooking.

Cooking extruders have been generally accepted in food processing industry because of their versatility and ability to consistently produce a given product to a given set of pre-determined specifications.

Classification of Extruders

Because of the versatility of food extruders i.e., they can be utilized for a number of different purposes, they are classified as : low shear, medium shear and high shear. The low shear extruder classification can be further divided into a low shear cooking type and low shear cooling/forming type. The shear referred to in these classifications is the amount of viscous shear, which is turned into heat for cooking within the extruder. Typical products and general characteristics vary with the type of extruder and are given in Table 1.

Extrusion equipment are also classified on the basis of moisture content of feed ingredient normally used in the extruder and the details are presented in Table 2.

Extrusion Systems

There are many extruder systems in the market for extrusion cooking viz. single screw and twin screw of the single screw extruders. It is the core - progressive designs which are the most common in extrusion cooking. These can only be fed with a grain spectrum, they mix poorly and the cooked product tends to bake to the screw surfaces when operated dry. Tangential twin-screw extruders mix better, but do not have any advantages otherwise. Intermeshing twin screw extruders should be self

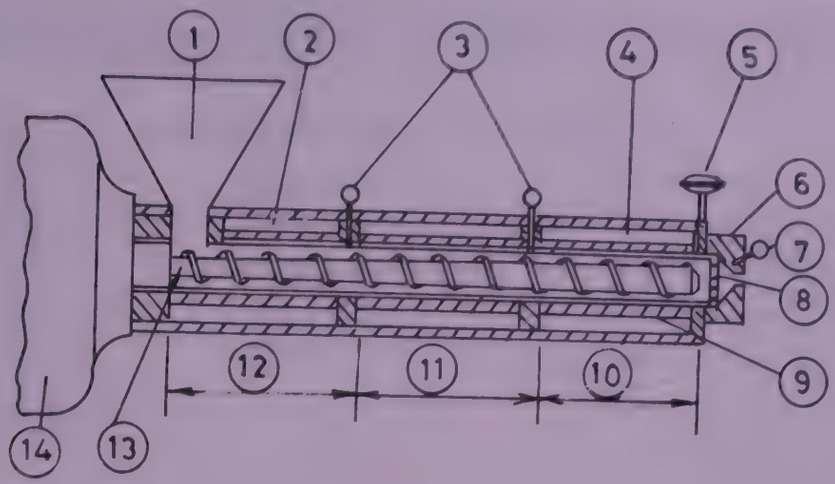

Fig. 1. Component parts of high-shear cooking extruder

1. Feed hopper 2. Cooling water jacket 3. Thermocouples 4. Barrel Steam jacket 5. Pressure transducer 6. Die 7. Discharge thermocouple 8. Breaker plate 9. Barrel with hardened liner 10. Metering section 11. Compressed section 12. Feed section 13. Screw with increasing root diameter 14. Drive gear reducer & thrust bearing.

cleaning and cylindrical, as a tapered design does not permit simple screw optimazion on the building block system.

Co-rotating machines have a very good mixing effect and homogeneous stressing of the product with a narrow residence time spectrum. The only advantage of counter-rotating machines is their forced conveyance in closed chambers,

Table 1. Single screw extruder classification

	Low Shear	Medium Shear	High Shear
Product moisture %	25-75	15-30	5-8
Product density (Gms/Litre)	320-400	100-510	22-200
Maximum barrel temperature (^{0}C)	20-65	55-145	110-180
Max. barrel pressure (kg/cm^2)	6-63	21-42	42-84
	580-6178	2059-4119	2119-8238
$\left\{\frac{\text{Screw diameter}}{\text{Channel depth}}\right\}$	3-5.3	5.0-8.5	8.0-18.0
Parallel flow channel (n)	1	2	2 or 3
Screw speed (RPM)	Less than 100	Greater than 200	Greater than 200
Energy conversion (kW/kg)	0.01-0.04	0.02-0.08	0.10-0.16
Typical products	Pasta products, third generation snacks, meat products, gums	Textured soy breading, expanded pet food, semi-moist pet food	Snacks, breakfast cereals, breading, thin boiling starch

Table 2. Classification of extruders on the basis of feed ingredient moisture content.

Feature	Low Moisture	Intermediate Moisture	High Moisture
Feed moisture	M≤ %	28%>M>20%	M ≥ 28%
Source of input	All energy input from viscous dissipation of mechanical energy input	Equal energy input from viscous dissipation of mechanical energy and steam injection	Majority of energy comes from steam injection with very little energy coming from the conversion of mechanical energy to heat.
Mechanical energy	0.10 kW-h / kg	0.04 kW-h / kg	0.02 kW-h / kg
Product drying	None, require product cooling (6% moisture loss)	Some product drying required (12% moisture removal)	Extensive product drying required.
Product shape	Minimum shapes available	Many shapes available	Maximum flexibility
Product density	Low density	Moderate density	Wide range.
Ingredients	Should contain 7% fat	Few limitations	Few limitations
Capital cost	Low to high	Modern to low	Moderate to high
Maintenance cost	High	Moderate	Low to moderate
Manufacturers	Brady, MFM, Insta-pro, Collet extruders	Anderson-IBEC, Wenger	Anderson-IBEC Bonnot Wenger.

(Source : Harper , 1979)

which can be used to produce local pressures for dissolving processes in a low viscosity slurry. More exotic-four screw machines are for devolatizing processes and planetary roll extruders.

When considering the cooking-extrusion of foods and feeds, a distinction can be made between single-screw extruders and twin screw extruders, the main difference being in the conveying mechanism (Table 3). In the single screw extruder, conveying action is the result of two friction effects : first the friction between screw and product and second the friction between barrel and product. In single screw extruder, the barrel wall is an important part of design whereas in twin screw extruder, screw geometry itself is important. Main differences in the two are explained in Table 3.

There are many extruder systems in the market for extrusion cooking.

Advantages of Extrusion Cooking

The use of extrusion cooking has many distinct advantages :

- Versatility - a wide variety of foods can be produced on the same basic extrusion system. Flavours can be added to the product.
- High productivity - an extruder has greater production capability than other cooking/forming systems.
- Low operational cost ; Labour and floor space requirements per unit of production are smaller than other cooking/forming systems.
- Product shapes - extruders can produce shapes not easily obtained using other production methods.
- High product quality and hygiene : The high temperature and short time process minimize nutrient

degradation, while destroying microorganisms. Good hygiene can be maintained easily.

- Production of new/fabricated foods : extruders can modify vegetable proteins, starches and other food materials to produce new food products.
- No effluents - no process effluents or hazardous materials are produced.

Limitations of Extrusion Technology

Some of the typical and critical limitations of extrusion technology are :

- High capital cost : Even the smallest extrusion unit costs not less than Rs. 25 lakhs (5 tonne/day). Many extruders of proven capability and range are not yet being manufactured indigenously.
- Non-availability of spare parts : Being mostly imported machinery, spares are generally not locally available resulting in loss of production. Moreover, if at all available, they are available at exorbitant prices.
- Repairs and maintenance : Requires very high level of skills.
- Power failure : In case of power failure even for a short duration, the operation has to be stopped for not less than 2-3 hrs, resulting in production losses. Having a standby captive power plant does not necessarily solve the problems satisfactorily.
- Increased packaging cost : The product being puffed/expanded has low bulk density, leading in turn, to increased packaging and handling costs.
- Start-up time : Being a continuous process technology, the process can not be stopped at will because start-up time is high.

Extrusion cooking, a modern HTST process is being increasingly used in food and chemical industries.

Extrusion Application in Food Industry

Extrusion cooking, a modern HTST process is being increasingly used in food and chemical industries. New products are being created and well known ones are copied and made more advantageous by

Table 3. Main differences between single and twin screw extruders

	Single screw extruder	Twin screw extruder
Main energy supply	Viscous dissipation	Heat transfer to barrel
Transport mechanism	Friction between metal and food material	Positive displacement
Throughput capacity	Dependent on moisture and fat content and pressure	Independent
Approximate specific power consumption per kg. product	900-1500 kJ kg^{-1}	400-600 kJ kg^{-1}
Heat distribution	Large temperature differences	Small temperature differences
Mechanical power dissipation	Large shear forces	Small shear forces
Degassing possibilities	Simple	Difficult
Rigidity	High	Bearing construction is vulnerable
Capital costs	Low	High
Minimum water content	10%	8%
Maximum water content	30%	95%

Table 4. Extrusion cooked products to replace conventional processes.

Product group	Product example	Conventional process
Modified cereal flours	Baby food	Drum dryer
Animal food	Petfood	Autoclave or oven
Dairy food	Caseinate	Stirred tank reactor
Flavours	Roast flavours, caramel, cracknel	Roasting tank
Baked articles	Flat bread, biscuits	Baking oven
Breakfast cereals	Puffed rice, cereal flakes	Puffing gun Batch cooker
Farinaceous food	Class noodles, fish noodles	Cooker
Sweet articles	Liquorice, fruitgums	cooker and mogul
	chocolate	Conche

replacing conventional machines and equipment (Table 4) by an extruder cooker, which can carry out many of the physico-chemical processes.

Selec ion of an extruder depends or the type of end - product de:ired (Table 5).

After selection of proper extruder - cooker, it is necessary to know about the process parameters (Table 6) that should be taken into account for proper functioning of the system to get desired product quality. Slight variation in the processing parameters and feed supply parameters result in appreciable change in the product properties.

Extruder Process Parameters and Properties

The present estimates of application of extrusion technology indicate (in percentage) use as feed stock (20), pet food (25), texturized

Table 5. Extruder application for food products

Type of e truders	General characteristics	Snacks	Cereals	Pasta	Confec-tionery	Pet foods	Sausage	Protein supplements & meat analogens
Direct (Positive-displacement)	Very low shear, continuous	X			X		X	
Hydraulic or pneumatic ram	low shear continuous				X			
Intermeshing twin screw								
Hybrid of direct & indirect								
Non-intermeshing twin screw	High shear, continuous				X			
Indirect (viscous-drag)	Low shear continuous	X	X		X		X	
Roller	High shear,							
Single screw	continuous	X	X	X	X	X		X

Table 6. Extruder process parameters and properties

Feed-supply properties	Process parameters	Product properties
Choice of the supply	Pressure profile	elasticity
Moisture content	Temperature profile	Hardness
P.D.I.number	Thermal-load	Hydration ability
Purity	Shear-load	Density
Fat content	Residence time	Morphology
Particle size distribution	Distribution	Degree of texturization
	Moisture correction	
Rheology	mixing	
	chamber or channel filling	

vegetable protein-TVP-(20) and instant foods (15), confectionery (10), pasta (5), simple snack and (3-4), baking (1).

Protein Supplemented Foods

Ordinarily, cereal flours, tubers and their derivatives can be processed into snack foods, breakfast cereals, confectionery items, and pre-cooked starches for industrial applications. Legume-based raw materials can be transformed into texturized vegetable meat extenders, meat analogues and pre-cooked soup powders. Mixtures of cereals and protein sources like legumes/oilseeds can be transformed into ready-to-eat or semi-cooked foods with improved protein levels.

While considering the advantages of extrusion cooking technology, need of protein enrichment of food products to meet nutritional needs on cost and availablity of some indigenous manufacturers should be taken into account (Table 7). The extrusion technology may now be useful technique particularly for production of protein -supplemented extruded products for consumption in a country like India. However, product or process selection should be such that the end product does not go beyond the reach of the targetted people for whom the protein-supplemented

Table 7. List of extrusion cooker manufacturers in India

Extruder	Indigenous manufacturer
Wenger type	i) M/s. Esskay International, 53, Infantry Road, Bangalore - 560 001. ii) M/s. Spectoms Engg. Pvt. Ltd., Bhahacharjee Road, Purshottam Estate, Near Jala Ram Mandir, Vadodara.
Insta Pro-type	i) M/s. Age Technologies Pvt Ltd., 712, GIDC, Makarpara, Vadodara - 390 010.

Table 8. Cost and nutritive value of food products produced by extrusion cooking

Product	Ingredients (cereal : oilseed)	Nutritive value/100g Protein	Calories	Cost/*kg. Rs.
Extruded pellets (spices)	wheat, lowfat soyflour	15	415	4.47
Extruded powder (sweet)	-do-	14	400	4.47
Sweet ready mix	Wheat, soy	14	400	4.40
Fried noodles	Rice, groundnut protein	15	500	9.87

*base year 1987.

products are produced. Thus, it would be essential to carefully select the products, processes, equipment and technologies suitable for our country.

Product and Equipment Selection

Ready-to-eat extruded products with oilseed as protein source could give the affordable product to the poor. The commercial production by a Hyderabed-based factory has established the suitability of extrusion cooking technology for production of ready-to-eat extruded products at low costs (Table 8). Another extruded product which is being produced on large scale in our country is the soy-chunks or nuggets. The product available through consumer packs is of relatively better quality compared to bulk packing available with retailers, but costly for poor. Unless the cost is lowered to a level affordable by the poor who need nutritional care, it may not be accepted. Also, the chunks/nuggets, though a high protein and non-conventional product for vegan population, could not form a part of dietary article for those who can afford.

Another extruded product which is being produced on large scale in our country is the soy-chunks or nuggets.

To make, oilseed protein processed through extrusion cooking technology, affordable by the needy poor to our

Table 9. Quality of extruded full fat soyflour obtained at different dial settings of feeder (Inta-pro-Extruder)

Dial setting	Moisture content % d.b.	T.A. Inactivation %	Colour of soyflour Whiteness
Raw sample	8.43	0.00	69.80
25	3.35	43.35	54.00
30	3.66	35.65	55.70
35	3.79	29.00	57.90
40	3.74		56.40
45	4.23	22.66	58.90

Table 10. Overall quality scores for soy-fortified bread (Fortification : 12%)

Quality	Bread		
	Low fat (INTSOY)	Full fat	Standard white
External characteristics	28.8	29.0	35.0
Internal characteristics	25.9	27.0	30.0
Eating qualities	29.0	31.0	35.0
Total	**84.6**	**87.00**	**100**

country, we may have to restrict initially for primary processing of oilseeds. The extrusion cooker can be used for primary processing of soybeans like dry extrusion cooking of soybeans and dry extrusion cooking of soygrits for production of full-fat soyflour, suji and medium fat soy flour. The quality characters of soy flour produced by dry-extrusion cooking in Insta-pro-dry-extruder reveal the suitability for use in the food product (Table 9).

These products can be, in turn, used in supplementation of conventional foods, bakery products etc. Good quality bread (Table 10) can be obtained by 12 per cent supplementation of wheat flour by soyflour containing about 41 per cent protein, 22.5 per cent ash and 3.4 per cent moisture.

The full-fat soyflour produced by extrusion cooking may find a prominent place in the traditional Indian dietary. Like-wise, a medium-fat soyflour can be put to variety of uses including bakery products, conventional foods etc. Extrusion cookers can be useful for primary processing, if nutritional improvement of the poor is the priority. Alternatively, protein -supplemented ready-to-eat and semi-cooked extruded products can find a place in Indian market for consumption by common man.

The full-fat soyflour produced by extrusion cooking may find a prominent place in the traditional Indian dietary.

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Potential of Goat Milk and Its Products as Health Food

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Introduction

In India, goats with a population of 112 millions, produce two million tonnes of milk contributing a meagre 3.5% to the total milk (56.7 million tonnes) production (FAO, 1992). Goat milk is consumed by the poorer section of society, who maintain these animals to meet a part of their daily nutritional requirements in addition to supplement their income and hence, goat is correctly called the 'poorman's cow'. Purported goaty smell, salty taste, poor scum formation due to finer fat globules and lack of agglutinating euglobulins and difficulty in cream separation are believed to be the few technological problems, related to goat milk processing into value-added products. As a result, goat milk in comparison to cow and buffalo milk is sold at a relatively lower price or by mixing with them. Consequently, surplus goat milk is rarely available in the market and has received limited attention with respect to processing. Studies carried out by several workers have shown that other products like *paneer*, whey drink from *paneer* whey (Prasad and Agnihotri, 1991; Agnihotri, 1993; Agnihotri and Pal, 1993a; Pal and Agnihotri, 1993), *khoa* (Jailkhani and De, 1979; Agnihotri and Pal, 1994), *Burfi* (Agnihotri and Pal, 1994) *chhana* and *chhana*-based sweet meats (*Sandesh*) (Jailkhani and De, 1980; Agnihotri and Pal, 1994), *dahi*, yoghurt, cheese such as *mozzarella* and cheddar type cheese (Singh *et al.*, 1990; Kanawjia *et al.*, 1992; Latha Sabikhi and Kanawjia, 1992; Singh *et al.*, 1992; Agnihotri and Prasad, 1992, 1993; Agnihotri and Pal, 1993a) ghee (Singh and Gupta, 1982; Arora and Singh, 1987), and dried goat milk powder (Om Prakash, 1981) could be prepared exclusively from goat milk by admixing cow and buffalo milk at certain ratios.

Interest in dairy goats and goat milk products is presently a part of the trend in health food consumption in several developed countries.

Recently, in developed countries of the world, research on goat milk has shown great nutritional and medicinal value of this product. Interest in dairy goats and goat milk products is presently a part of the trend in health food consumption in several developed countries. Surprisingly, India having the largest goat population and where nearly 40 per cent human population suffers from protein malnutrition, the milk production potential of this remarkable animal has remained untapped.

Goat Milk Composition and Nutritional Considerations

Widely varying values for constituents of goat milk have been attributed to age (Mittal, 1979), breed, season, stage of lactation (Agrawal and Bhattacharyya, 1978; Kala and Prakash, 1990; Singh and Sengar, 1990; Voutsinas *et al.*, 1990; Prasad *et al.*, 1992; Agnihotri and Pal, 1993b; Pal *et al.*, 1994) and plane of nutrition (Sachdeva *et al.*, 1974; Singhal and Mudgal, 1985).

A comparison of goat milk composition and its nutritive value with cow, buffalo and human milk is presented in Table 1. Although goat, cow and human milks are almost isocaloric, different proportions of energy are supplied by lactose

Table 1. Chemical composition of the milks of goat, cow, buffalo as compared to human milk.

	Goat	Cow	Buffalo	Human
Proximate composition :				
(g/100g)				
Water	87.5	87.7	81.0	86.7
Fat	4.0 - 4.5	3.8	8.8	4.1
Proteins (N x 6.38)	3.2	3.3	4.3	1.3
Lactose	4.6	4.7	5.0	7.2
Energy (K cal)	71.0	65.0	117.0	69.0
Minerals				
(mg/100g) :				
Na	34.0	50.0	19.0	14.0
K	180.0	150.0	90.0	58.0
Ca	129.0	120.0	210.0	34.0
Mg	20.0	12.0	-	3.0
P	106.0	95.0	130.0	14.0
Fe	0.04 - 0.1	0.05	0.2	0.07
Cl	130.0	95.0	-	42.0
Vitamins				
(per 100g)				
Vitamin A(IU)	185.00	126.00	160.00	241.00
Thiamin (mg)	0.05	0.04	0.04	0.014
Riboflavin (mg)	0.14	0.16	0.10	0.04
Pantothenic acid (mg)	0.31	0.314	-	-
Niacin (mg)	0.28	0.08	0.10	0.18
Vitamin B_6 (mg)	0.05	0.04	-	0.01
Folic acid (mg/litre)	6.00	50.00	56.00	50.00
Vitamin B_{12} (mg)	0.05	0.14	0.14	0.02
Vitamin C (mg)	1.50	1.50	1.00	3.70
Vitamin D (mg)	0.06	0.03	-	0.025
Biotin (mg)	2.00	2.00	-	0.70

Sources : Anjaneyulu *et al.*, (1985); Darnton - Hill *et al.*, (1987); Chandan *et al.*, (1992).

and proteins (Darnton-Hill *et al.*, 1987). Goat milk contains less folate, vitamin D, vitamin C, vitamin B_{12} than cow or human milk. Infants fed exclusively on goat milk should be ensured oral supplement of folic acid to avoid folate deficiency in the long run (O' Connor, 1992). In an experiment with 38 children over 5 months, half drank one litre goat milk and other half, 1 litre cow milk daily. The results showed that both groups grew well, but goat milk group had significantly higher plasma levels of vitamin A, calcium, thiamine, riboflavin, niacin and higher haemoglobin levels and increased skeletal mineralization (Mack, 1952), which might be due to higher concentration of certain minerals and vitamins in goat milk as compared to cow milk. In another nutritional study, rats grown on goat milk had significantly better growth, higher liver weight, greater haemoglobin iron gain and higher iron abosrption rates than in rats grown on cow milk (Park *et al.*, 1986). Recently, goat milk has been advocated as an important nutritional supplement to breast feeding during the later part of infancy (Puranik, 1992). Furthermore, goat milk was found to be significantly lower in commonly determined bacterial species than cow and buffalo milk. Heavy metal (Cr, Cu, Cd, Mo and Sn) contamination of goat milk appeared to be less than those of cow or buffalo milk (Saraswat and Kumar, 1992). Moreover, in comparison to cow and buffalo, goat can be milked as often as

required to get fresh milk to feed babies.

Medicinal Value of Goat Milk

It is a general belief among rural people that goat milk is nutritionally superior to cow and buffalo milks, as far as infant feeding is concerned. Now, scientific evidences are also available on nutritional superiority of goat milk over other milks. Goat milk has been found to be suitable to those patients, who are sensitive to cow milk proteins (Breneman, 1978). For infants with cow milk protein intolerance, paediatricians generally recommend change to a vegetable protein soy-based formula. But it has been observed that 20-50% of such infants also react adversely to soy protein (Lothe *et al.*, 1982). For such cases, evaporated milk could be a better alternative to fresh cow milk, because the heat treatment during evaporation process makes milk caseins more digestible and less allergenic, but evaporated goat milk would be still better, because goat milk caseins differ in amino acid composition from cow milk caseins and are more digestible (Park, 1991; Haenlein, 1992). Like cow milk, goat milk caseins have the same four species of alpha-S-1, alpha-S-2, beta and kappa, but in different proportions and different genetic polymorphisms (Boulanger *et al.*, 1984; Addeo *et al.*, 1988). Electrophoretic mobility under standard conditions shows that β-casein is the major component of casein fraction of good milk, whereas αS_1-casein is the major component of cow milk casein. αS_1-casein level in goat milk varies from 0.12 g/litre to 2.70 g/litre (Mora - Gutierrez *et al.*, 1991). Level of αS_2-casein in goat milk is relatively higher, but total αS_1- and αS_2-casein fractions are lower than αS_1-fraction of cow milk. Such differences might contribute to soft curd forming properties and better digestibility of goat milk in the human digestive tract and least allergenicity to children.

Recently, goat milk has been advocated as an important nutritional supplement to breast feeding during the later part of infancy.

Goat milk contains adequate amounts of essential amino acids, excepting tryptophan. (Anjaneyulu *et al.*, 1985).

Goat milk fat, especially fatty acids, which differ in carbon chain length and saturation, has nutritional and medicinal significance. Goat milk fat has 35% medium chain fatty acids (MCT) (C6-C14) compared to cow milk fat (17%). Three MCT named after goats : caproic (C6), caprylic (C8), capric (C10), alone contribute to 15% of fatty acid content in goat milk in comparison to 5% in cow milk fat (Haenlein, 1993). In general, these fatty acids are not metabolized like long chain fatty acids. This alternate metabolism causes the body to quickly utilize medium chain fatty acids for energy (similar to carbohydrates). As a result, goat lipids may functionally behave differently from lipids of cow milk. Since goat milk lipids exist as a finer emulsion, which does not form clusters like cow and buffalo milk fat globules do, it is conceivable that their large surface area would enhance lipase action, making it easier to digest (Chandan *et al.*, 1992) by the infants, invalids and the convalescents.

Goat milk fat, especially fatty acids, which differ in carbon chain length and saturation, has nutritional and medicinal significance.

The capric, caprylic and other MCT have become an established treatment in patients suffering from malabsorption, chyluria, steatorrhoea, hyperlipoproteinaemia and in cases of intestinal resection · coronary bypass, premature infant feeding, childhood epilepsy, cystic fibrosis and gallstones, because of their unique metabolic ability to provide energy, besides lowering serum cholesterol, inhibiting and limiting cholesterol deposition in tissues, dissolving cholesterol gallstones and contributing to the physiological well-being of growing children (Schwabe *et al.*, 1964; Greenberger and Skillman, 1969; Kalser, 1971; Tantibhedhyangkul and Hashim, 1978). This area of MCT justifies the uniqueness of goat milk and goat milk fat in human nutrition and medicine (Haenlein, 1992). A medical focus group in 1989 sponsored by Jackson-Mitchell under the direction of Direct Marketing, Inc., USA brought out the fact that goat milk is being recommended by doctors for AIDS patients (Jackson, 1992). Goat milk is considered relatively safer than cow and buffalo milks as far as tuberculosis is concerned, since goat prefers open air life with consequent rarity of exposure to tubercule bacilli infection. Medicinal value of goat milk has also been documented in Ayurveda and Bhavprakash and

recommended as an effective cure for the patients suffering from tuberculosis, dysentery, cough and cold, and certain gynaecological disorders. From the foregoing discussion, it appears that goat milk has tremendous potential as an infant food as well as health food for adults and patients suffering from different types of metabolic diseases.

Export Potential of Goat Milk and Milk Products

There is an ever expanding market for goat milk and its products worldwide. In recent years, EEC has set limits for production of cow milk products. Diversification of goat milk products will undoubtedly stimulate the expansion of goat milk and goat milk cheese sector. Countries like United Kingdom, which are not traditional goat milk producers are striving to increase its production. Goat milk cheese has gradually gained popularity among ethnic groups, health food lovers and private goat farmers in USA (Park, 1992). Due to continued shift in the consumer tastes to exotic speciality cheese, there is an ever increasing demand of goat cheese from domestic and foreign sources (Kosikowski, 1986). As a result, around 447 tonnes of caprine cheese was imported from France, which comprised approximately 20% of the total imported cheese to the USA in 1988 (Park, 1992). Cheese industry in India is coming up in a big way with an annual growth rate of 20% in cheese production. Because of its proven role in improving the quality of buffalo milk cheddar and *mozzarella* cheese, which is otherwise said to be unsuitable for these products, goat milk can prove to be a boon to Indian cheese industry.

India having the largest goat population and some of the world famous milch breeds like Jamunapari, Beetal, Barbari, Surti, can very well exploit such highly remunerative overseas market giving more emphasis on hygienic goat milk production and processing and establishment of processing centres at various important locations of the country. Moreover, consumer interest in harmful toxic residue-free milk will further benefit India, where natural pasture grazing of goats predominates. In spite of good efforts in dairy developments, the organized sector is able to process only 12-15% of total milk production (Chopra, 1993). No such data are available exclusively for goat milk. Under such circumstances, to augment the production of goat milk products, streamlining of goat milk collection should be ensured. This can only be achieved through establishment of goat producers' co- operative in the line of milk producers' co-operative under operation flood projects. There are also vast opportunities for export of milk and milk products to Gulf countries, which should be suited to their taste and environment.

Promotion of consumer perception, identification of proper distribution and marketing channels, research and development of speciality type new dairy products, enforcement of strict quality control measures and proper packaging are priority areas for development of goat milk industry in the country.

Conclusion

A vast population is ignorant about the nutritional and medicinal value of goat milk, which needs to be brought to the knowledge of common people through print and electronic media and efforts should be made to develop and promote goat milk products as health foods to make a dent in the rich Gulf market. However, there is a new consumer awareness and growing market world over for goat milk and its products. Promotion of consumer perception, identification of proper distribution and marketing channels, research and development of speciality type new dairy products, enforcement of strict quality control measures and proper packaging are priority areas for development of goat milk industry in the country. Enrichment of scientific literature in the field of biological, nutritional and metabolic uniqueness of goat milk and milk products would help in establishing goat milk in the elite class of health foods.

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For the requirement of qualitative and quantitative production (GMP), special models are available. In addition to features indicated above models with (i) vacuum upto 100 mbar to prevent air inclusion in final product, and to reduce contamination, (ii) cooking and heating indirectly by water by means of double jacket are also available.

For the production of high quality : * ointment, creams, gels, pastes * emulsions and suspensions * solids and liquid mixtures * solutions, * fine size reduction of drugs, etc. the following models are available
* UM5 Pharma, UM5 Universal : 5 litre, 0.2-2.5Kg/B, 0.75KW
* UM12 Pharma, UM12 Universal : 12 litre, 1.5-5Kg/B, 1.5/1.9KW
* UM 44E Universal : 45 litre, litre, 30KG/B, 4/5.5KW
* UM 12S, Kg 160 S Kitchen : 1.4/1.8KW

Higher production models also available. Please contact with details of product recipe, specifications, batch sizes, and required hourly throughput to Tricon, 5A Mayur, 771 Deccan Gymkhana, Pune - 411 004. Tel/Fax : (0212) 352451.

Instrument to Determine Dietary Fibre in Food Samples

Researchers all over the world have been experimenting with different methods for reliable estimation of the dietary fibre content in human food. This is a very important parameter which influences the incidence of various diseases connected with the human digestive system. AOAC has now approved a method for total dietary fibre (985.29) in food and food products using enzymatic - gravimetric method. Also, some of the methods enunciated by Prof. Asp and other scientists have for TDF, soluble dietary fibre and insoluble dietary fibre determinations

Tecator AB, Sweden, after several years of collaborative work with international organizations have come out with an analytical instrument

called Fibertec-E for determining the above fibres. It can also be used as a sample preparation tool for further colorimetric and chromatographic studies. This instrument eliminates the normal human errors involved in the method and gives highly reproducible and accurate results. The instrument also makes it possible to analyze 6 samples simultaneously at a much faster rate compared to the manual method. Some of the essential accessories like a Shaking Water Bath is also included in the instrument.

For further information on the various dietary fibre methods, AOAC, AACC Approvals and details about the Fibretec = E instrument, *please contact* : Mr. K. S. S. Raghavan, Tecator, 296, 5th Main, 8th Cross, S. T. Bed Layout, Koramangala, Bangalore - 560 034, Fax No. : 080-6648476.

New Machinery to Peel Raw Mangoes

Food technologists at the Indian Institute of Horticultural Research (IIHR), Bangalore, have developed a continuous peeler of raw mangoes which might have commercial potential.

Around 9.45 million tonnes of mangoes are produced in India and about one per cent are processed into different products. About 9.5 per cent is estimated to go into making pickles.

Since peeling was done manually, it was labour-intensive and tedious and hence, a mechanized peeler needed to be developed.

The technologists of IIHR have developed a peeler which consists of power transmission, a concave wheel, guide drum, casing and a frame.

The inlet and outlet for the unpeeled and peeled mangoes are provided in the casing. The concave wheel, with sharp projections, revolves at 250 rpm with a two hp motor.

The guide drum revolves at two rpm and maintains the continuous feeding and discharge of the mangoes. It has a capacity of 200 kgs per hour with a single concave wheel of 900 mm diameter.

Manually, it will be 7.5 kg per person. The cost works out to Rs. 45 per tonne against Rs. 667 per tonne, according to 1993 rates.

The peeler is found suitable for mangoes of dimensions up to a length of 80 mm and a diameter of 60 mm. The dimension of the mango is limited by the cavity provided on the wheel.

The diameter and the number of concave wheels could be increased to enhance the peeler capacity.

In the present model, three concave wheels with different sizes of cavities can be provided, accounting for the big, medium and small fruits.

Scientists from IIHR said that the machine could be used for peeling papaya and other hard fruits by changing the size of the cavity.

Speed Variator

Novatec has developed speed variators with model numbers VT3, VT7, VT10 and VT15. The variator delivers infinitly variable, stepless speed ranges at the output shaft, while the unit is running. The variator is coupled to an AC motor. The prime mover can also be of different modes instead of AC motor. For example, if the input speed is 1,440 rpm different output ranges between 1,000 and 40 rpm can be achieved. The output speed ranges vary in proportion to input speed. The variators are coupled to 0.25, 0.37, 0.55, 0.75 kW AC motors. Other sizes are under development. The variators are highly efficient and very compact. The units are free of vibrations and noise with reliable speed holding and smooth drive. The variator is totally enclosed and ideal for operation in hostile environment, and is practically maintenance free with periodic lubrication. The variator delivers very high torque for the same power input which results in 100% savings in power while installation, itself. The output speed can be varied while the unit is running by rotating an easily accessible knob at the top of the unit. The variators can be supplied either in foot or flange mounting and also with or without prime mover to suit requirements. Applications are in industries such as ceramics, chemical, pharmaceutical, textile, paper, cable, food, bottling, rubber and plastic. This variator is of special interest for manufacturers and users of conveyor systems, packing machinery, leather goods making machinery, pharmaceutical machinery, automation lines, feeders, agitators, assembly lines of electronic and light engineering goods as the units provide savings in space and power. This variator can be made flameproof.

For more details write to :
Novatec
Shed No 6A, Type III, Industrial Estate, Kukatpally
Hyderabad-500 037
Andhra Pradesh

Continued on page 50

RESEARCH ROUND-UP

CD-Strip for Quick Detection of Butter Yellow, a Toxic Artificially Added Synthetic Colour in Mustard Oil

Scientists at the Industrial Toxicology Research Centre, Lucknow have developed a simple, on the spot colour detection (CD) strip so as to detect admixture of butter yellow in oils.

The CD-strip will serve as a handy tool at the retail outlet by cautious dealers, consumers/house-wives themselves ; consumers guidance organizations/societies and for random preliminary checks by food inspectors and health authorities even at the remotest areas.

The test is easy to perform, takes only a few minutes and require only visual observation. The detection of butter yellow can be carried out simply by placing drop of the test oil on a small piece of the CD-strip. If the colour of the spot changes to pink, the oil is considered to be contaminated with butter yellow. For obtaining the approximate concentration of butter yellow, the colour can be matched with the standard colour printed on the cover sheet of strips. The minimum detectable limit of this test strip is 0.001% (10 ppm).

The CD-strips are available as booklet of five chemically precoated paper strips each, with an outer cover sheet showing colours obtained with different concentrations of butter yellow. A single test will cost less than 50 paisa.

Cost Break up for CD Strips

(a) Capital investment
(i) Equipment Rs. 10,000.00
(ii) Building etc. (covered floor area 10′ x 10′) Rs. 50,000.00
(b) Consumables for 10,000 strips
Raw materials and manpower for 10,000 strips Rs. 10,000.00
(c) Cost of production based on (b) at Re. 1/- per strip
(d) Demand based on advertising capacity
(e) Terms of know how transfer
(i) Payable at the time of signing the agreement Rs.1,00,000.00
(ii) Royalty on sale @ 10%
(iii) Non Exclusive.

For details write to :
Director, Industrial Toxicology Research Centre,
Mahatma Gandhi Marg,
P.O.Box 80,
Lucknow - 226 001 U. P., India.

Parboiling of Brown Rice Saves Energy

Parboiling of brown rice (paddy after shelling) has been found to be promising. In this process, energy requirement is reduced by 40% due to increase in processing capacity and improvement in heat transfer. Cooking time of the rice is improved by at least 30%.

This process aids in modernization of rice milling, as husk and bran are collected separately. Natural contamination and colour, odour development due to soaking of husk is avoided.

The process has been well tested for small capacity parboiling (75 kg brown rice per batch) in drum parboiler developed by harvest and post-harvest technology scheme (ICAR). IIT, Kharagpur. The product has been organoleptically evaluated and found suitable.

The net profit from parboiling brown rice in drum parboiler is Rs. 102/- per quintal, whereas it is Rs. 10/- and Rs. 46/- in traditional and modern methods, respectively.

For correspondence :
Nandita Kar
R. K. Jain
HPHTS (ICAR), PHTC,
I.I.T., Kharagpur - 721 302

Preserving Tender Coconut Water

The possibilities of preserving tender coconut water in plastic pouches of 200 ml capacity and in aluminium beverage cans of 200 ml/350 ml capacity were probed at the Defence Food Research Laboratory by Mr. A. N. Srivatsa and Dr. (Mrs.) R. Sankaran and microbiological, chemical and organoleptic analysis have been completed up to three months storage under ambient conditions.

The investigations revealed that the products were found to the generally acceptable and it remained microbiologically sterile and no seminar on significant chemical changes were noticed, according to a paper presented at the processing and marketing of coconuts organised by the Coconut Development Board.

Tender coconut water is a delicious and nutritious drink. It has a characteristic, but very delicate, flavour. It is rich in minerals, especially potassium and sterile in its natural form. Though attempts have been made to bottle mature coconut water, as a by-product utilisation of desicanned copra industry, no attempt has been made to preserve tender coconut water with its natural flavour.

NEW MACHINERY ..... Continued from page 48

Silicones and Speciality Lubricants

Gudmekk manufactures a wide range of silicone formulations and speciality functional chemicals. The product range includes silicone emulsion, fluids, silicone dielectric grease, vacuum sealants, 'O' ring bonder, envelope tube for precured tyres, shell mould releasers, textile softeners, defoamers and moly base greases, antiseize compounds, heat conductive paste for electric and electronic units. The lubricants find applications in industries such as rubber, plastic, PVC, paper, steel, cement, sugar, textile, electrical, electronic and pharmaceutical.

For more details write to :
Gudmekk Products
8-Madavaperumal East Street,
Alandur, Madras - 600 016.

Chemical Dehumidification System

Energy efficient, low cost operating and high performance dehumidification system using lithium chloride solution as the desiccant is designed by Rago & Rane Techno Engineers Pvt Ltd. Relative humidity as low as 1 to 2% is attainable at moderate room temperatures of 20 to 22^{0}C. Lithium chloride solution as a desiccant has several advantages over the conventional systems. Very low energy is required for regeneration. Conditioned air is never lost outside the system, as the absorber unit and the regenerator unit are independent. Air conditioned through the system is clean, dust-free and odourless. Bacteria to the extent of 97% is trapped and killed in the system. Performance does not get affected due to the external atmospheric conditions. The system is very useful for pharmaceuticals, gelatin manufacturers, soft electronics, photographic film industries, paper, food processing, synthetic textiles etc.

For more details write to :
Rago & Rane Techno Engineers Pvt Ltd
B-2, B-7 Sheetal Indl. Estate,
Kashi Mira Bhayander Road
Bhayander (East)- 401 105.
Dist Thane, Maharashtra.

Chilling Plants

Armec group offers a complete turnkey engineering services for industrial water/brine chilling plants of any capacity. It has engineered plants incorporating most reliable compressors with properly sized condenser and race way type evaporator chiller which can store refrigeration effect during idle hours and tube bursting problems are entirely avoided.

For more details write to :
Armec Group of Organizations
85 Tagore Nagar, Old Padra Road
Vadodara - 390 015. Gujarat.

Cooker/Warmer Heats Foods Fast

The Ideal Medalie Cookers and Warners offers a self-insulating thermostat well, made from polyester and glass fibers that are resistant to rusting, cracking and pitting. Promising the fastest heatup time of any cooker, these products cook, hold, and serve foods. Both cookers and warmers have true thermostats for precise temperature control and twice the water capacity of any competitive models.

For more details write to :
J D Honigberg International,
Dept CN
500 Central Ave, Northfield,
Illinois - 600 093, USA.

CFTRI HIGHLIGHTS

Automatic *Chapathi* Making Machine from CFTRI

Chapathis can now be continuously rolled and baked at a faster rate i.e., 600-700 per hour, with the help of the automatic *chapathi* making machine developed by CFTRI. This will help the hotels/industrial canteens/ community kitchens and other kitchen establishments to improve their efficiency and turnout *chapathi* production.

The machine has two units, a forming unit comprising a feeder, dough extruder, cutter and conveying system; and a baking unit. Prepared dough is fed into the extruder which forms/presses it into the sheets and the cutter cuts into individual *chapathis*. Formed *chapathis* move to baking unit on a conveyer where they are baked. *Chapathis* made in this machine have uniform quality with flavour and texture of the product made according to conventional method. One skilled and two unskilled workers are required to operate the machine. A dough mixer should also be installed along with this machine.

This machine is the first of its kind developed in the country and surely a step forward in the automation of catering industry.

CFTRI has 3 patents on this machine.

Details regarding the release of design drawings can be had from Director, CFTRI, Mysore - 570 013

Fruits and Vegetables Stay Fresh Longer with MAP

Modified atmosphere packaging (MAP) is a method applied to extend the storage life of fresh fruits and vegetables by suitably altering the proportion of gases present in the surrounding atmosphere, thus retarding the ripening process and other bio- chemical changes in them. MAP conditions are created inside the package either by the packed commodity itself as a result of respiration, or by externally controlling/monitoring the ratio of gases inside the package. A film of suitable permeability is used to pack the commodities.

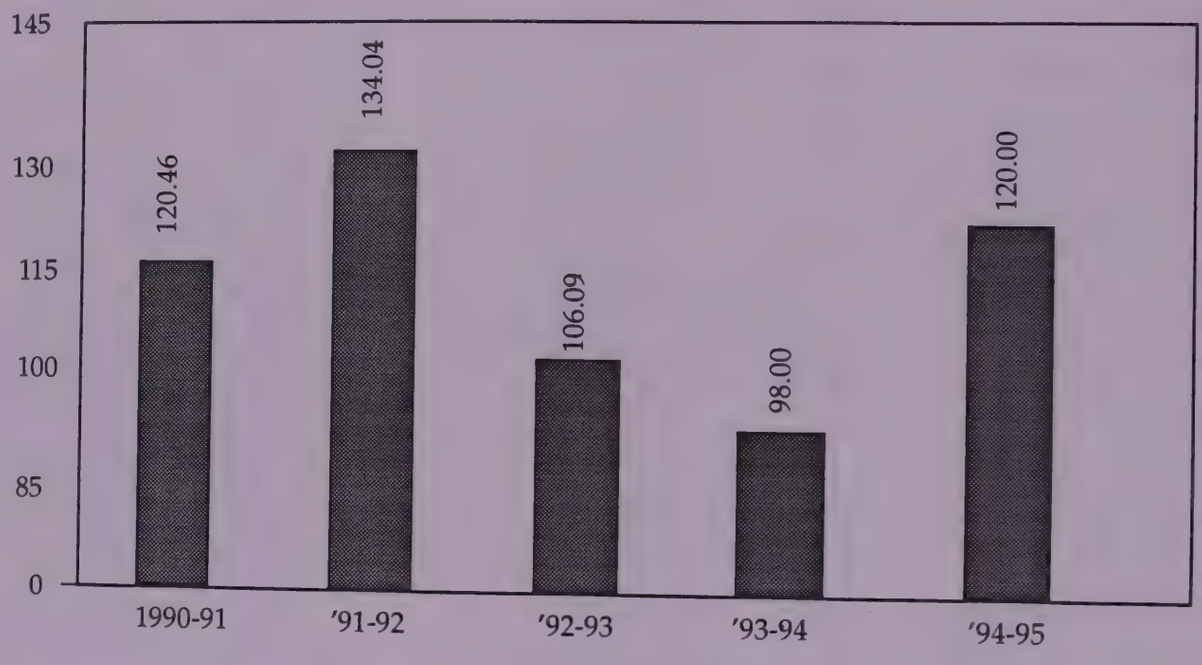
CFTRI has developed a MAP method for extending the shelf-life of some fruits and vegetables at ambient and optimum low temperatures. By this method, the storage life of bananas can be extended to 15 days at ambient temperature and that of carrots, capsicum, green chillies and tomatoes to 14, 13, 8 and 14 days, respectively at ambient temperature. Storage life can be further increased at optimum low temperature.

MAP method does not require high investment and can easily be adopted for long distance transportation and export by ship in reefer containers. It is also useful in countries where refrigerated transportation facilities are very expensive and are not available.

Details can be had from Director, CFTRI, Mysore - 570 013

DATA BANK

Sugar Production (in lakh tonnes)



* CMIE Forecast

Production of Groundnut In-shell and Export of Kernels

Year	Production of in-shell	Export of kernels	
		Quantity	Value
1990-91	75.1	35,473	62.43
1991-92	70.7	1,725	3.61
1992-93	79.0	5,315	9.56
1993-94	76.0	96,496	175.97
1994-95 (estimated)	78.5	55,000	110.00

Quantity in tonnes : Value Rs. in crores ;
Production in lakh tonnes.

Production of Honey from Major Sources by Different States (1991-92)

Name of State	Approximate Production of Honey in Tonnes	Sources
Andhra Pradesh	150	Citrus, Coriander, Niger Soapnut, Mixed Forest.
Assam	388	Citrus, Mustard & Mixed Forest Honey
Bihar	207	Karanj, Litchi, Mustard, Eucalyptus & Kasani
Gujarat	100	Babul, Sunflower & Wild Weeds
Haryana	108	Mustard, Eucalyptus & Berseem.
Himachal Pradesh	70	Sula, Litchi & Jamun
Jammu & Kashmir	54	Eucalyptus & Sula
Karnataka	582	Coffee, Jamun, Rubber tree, Soapnut, Mixed Forest Honey, Coriander, Cocopalm, Ber, Niger & Tamarind.
Kerala	1963	Rubber tree, Coffee & Cocopalm.
Madhya Pradesh	90	Mixed Forest Honey, Niger Mustard & Sunflower
Maharashtra	835	Jamun, Hirda, Pisa, Ber, Sunflower, Karvi & Coriander
Manipur	105	Mixed Forest Honey
Orissa	598	Mustard, Niger, Soapnut, Cashewnut & Mixed Forest Honey
Punjab	107	Mustard, Citrus, Litchi, Eucalyptus & Ber
Tamil Nadu	2373	Tamarind, Rubber Tree, Soapnut, Cocopalm & Wild flora.
Uttar Pradesh	105	Mustard, Litchi, Kasani, Eucalyptus & Jamun
West Bengal	500	Forest honey, Cashewnut, Mustard & Litchi.

Source Khadi Gramodyog (K.V.I.C.), September, 1993.

DATA BANK

Demand for Packaging Material/forms (IIP views)

Material/forms	1991-92	1994-95	2000 A.D.
Tin Plate Containers	465,090	523,160	636,500
Aluminium :			
- Foil	16,330	20,571	30,225
- Tubes	22,470	26,820	28,430
Plastics :			
- Semi Rigid/Rigid	185,000	233,000	342,350
- Films	280,000	375,000	610,000
Paper and Paper Boards :			
- Corrugated Boxes	583,900	715,300	1,003,250
- Composite Containers	123,480	142,900	182,300
- Multiwall Paper Sacks	38,720	51,500	82,900
- Cartons, Wrappers and Bags	602,000	696,100	888,400
Laminates	155,000	225,000	418,600
Glass Containers	973,000	1,100,000	1,338,300
Jute (Sacking and Wrapping)	1,167,000	1,300,000	1,300,000
Wood Based Containers	7.7 million (Boxes and Crates)	7.7 million (Cubic Mtrs)	7.7 million (Cubic Mtrs)

Source : IIP

ADVERTISERS' INDEX

TRADE FAIRS & GET-TOGETHERS

Bake 95 - Biggest-ever UK Bakery Show

With over 400 companies represented on 12,000 square metres of exhibition stand space and new enquiries for stands at record levels, the Bake 95 the 4th Food Processing Exhibition organized by Bakery Exhibitors Ltd. to be held at the National Exhibition Centre, Birmingham, England from October 1-4, 1995 will break all records for a UK bakery exhibition.

New products to be launched at the show include gas ovens, jelly spray machines, laser label overprinting, depositors, pie and flan machines, automatic roll production plant and tunnel ovens to name just a few. On the ingredients side, exhibitors will be launching new cake mixes, chocolates, savoury products, ethnic breads, cheescakes fruit fillings and a huge range of pre-mixes and speciality breads.

Packaging, hygiene and computer equipment for the baking industry will also be shown.

Admission to Bake 95 is free to trade visitors - tickets are available from the Bake 95 Hotline - phone or fax +44 (0) 1203 695440. Intending exhibitors should contact Chris Reynolds on +44 (0)1923 228577 or Mike Miles,

A special flight/hotel package for overseas visitors is available form Baxter Hoare Travel +44 (0)181 795 1326 with departures from your local airport.

Courses to be Conducted by Central Food Technological Research Institute

"Food flavouring - Technology, Analysis and Quality Control" (From 9th to 13th October 1995)

The outline of the course, training charges and desirable qualification are given below.

Brief outline of the Course

The course covers a wide spectrum of food flavourings, their analysis and quality control. The emphasis will be on specific flavourings materials, like spices, citrus oils, essential oils and oleoresins and aroma chemicals. The quality control covers standards, specifications and sensory aspects. This course will be beneficial to those involved in processing, analysis and quality control of flavourings.

Desirable Qualification

The minimum academic qualification required is a basic degree in Science/Agriculture/Technology/ Engineering or allied fields. Industrial personnel associated with production/R&D/HRD/QC management ; Research Fellows ; Academic staff are also eligible to attend the course. This may be relaxed in case of personnel having adequate experience in the field, but should have studied Science subjects at least in Pre-University or 12th standard. As the medium of instruction is English, knowledge of the same is essential.

Training Charges

The details of the Training Charges are as indicated below :

a. Training	Rs. 1900/-
b. Board charges	Rs. 450/-
c. Lodging charges	Rs. 150/-
Total Training charges (per participant)	Rs. 2540/-

Biodata of the candidate along with the training charges may be sent through crossed draft in favour of

Director, CFTRI,
Mysore - 570 013.

Workshop on Recent Developments in Metal Containers

(From 9th to 13th October 1995)

The outline of the course, training charges and desirable qualification are give below.

Outline of the course

- Tin plate container

Composition of base plate, Tin coating method, structure of Tin coating, Can fabrication, Corrosion in food cans.

- Tin free steel

Manufacture, fabrication, suitability for packaging food products.

- Aluminium container

Drawn and wall ironed can, Drawn and redrawn cans, easy open ends, suitability

- Recent development in metal can.

- Protective lacquers

Practicals/ Demonstration

- Determination of tin coating weight, porosity, grain structure, seam measurements.

Objective of the course

To highlight the problems in metal containers and the recent developments in the manufacture, fabrication and suitability of metal container for packaging of processed food products.

Desirable Qualification

The minimum academic qualification required is a basic degree in Science/Agriculture/ Technology/Engineering or allied fields. Industrial personnel associated with production/R&D/HRD/QC management ; Research Fellows ; Academic staff are also eligible to attend the course. This may be relaxed in case of personnel having adequate experience in the field, but should have studied Science subject at least in Pre-University or 12th standard. As the medium of instruction is English, knowledge of the same is essential.

Training Charges

The details of the Training Charges are as indicated below :

a. Training fee	Rs. 1900/-
b. Board charges	Rs. 490/-
c. Lodging charges	Rs. 150/-
Total Training charges	Rs. 2540/-

(per participant)

Biodata of the candidate along with the training charges may be sent through crossed draft in favour of Director, CFTRI, Mysore - 570 013.

Post-harvest Technology of Fresh Fruits and Vegetables

(from 6th to 17th November 1995)

The outline of the course, training charges and desirable qualification are given below.

Outline of the Training Programme Content :

Classification of fruits and vegetables
Maturity indices for harvesting
Grading methods, pre-cooling
Treatments with skin coating
Grown regulators for enhancing/delaying ripening
Methods of storage
Ambient evaporative coolling
Low temperature (cold storage)
Modified/controlled atmosphere
Freezing
Storage disorders
Post-harvest microbial spoilages and their control
Packaging and transportation
Cold storages and their maintenance
Basics of fruits and vegetable processing
Group Discussions

Desirable Qualification

The minimum academic qualification required is a basic degree in Science/Agriculture/ Technology/Engineering or allied fields.

Industrial personal associated with production/R&D/HRD/QU management; Research Fellows; Academic staff are also eligible to attend the course. This may be relaxed in case of personnel having adequate experience in the field, but should have studied Science subjects at least in Pre-University or 12th standard. As the medium of instruction is English, knowledge of the same is essential.

Training Charges

The details of the Training Charges are as indicated below :

a. Training fee	Rs. 3200/-
b. Board charges	Rs. 1055/-
c. Lodging charges	Rs. 325/-
total Training charges	Rs. 4580/-

(per participant)

Biodata of the candidate along with the training charges may kindly be sent through crossed draft in favour of Director, CFTRI, Mysore - 570 013.

BOOKS

Directory of Research and Education in Food Science, Technology and Engineering

The three-volume Directory of Research and Education in Food Science, Technology and Engineering, allows you to review the major centres in food research and education, assess their strengths and identify their key contact names. Vol.1 (Europe) and Vol. 2 (N. America) were published in 1993 and, to complete the series, Vol. 3 (Asia & the Southern Continents) will be published mid-1995.

This unique, three-volume Directory provides an invaluable international resource for anyone working in the food sector, whether in academia, industry or public service.

It is comprehensive and user-friendly

Over 800 universities, companies and other institutions are listed

Indexed by scientific field and institution

Entries are listed alphabetically by country and institution

The Directory is sponsored by the international Food Information Service (IFIS), the European Federation of Food Science and Technology (EFFoST) and the International Union of Food Science and Technology (IUFoST).

Prices

Volumes 1-3 : £150/US$270 (Complete set)

Volumes 1&2 : £90/US$160 (2 volumes) ISBN 0 86014 1675

Volume 3 only : £60/US$110

(Asia & the Southern Continents) ISBN 0 86014 168 3

Postage included, Airmail optional at additional cost :

Vol. 1-3 =+£15/US$27; Vol. 1&2 = +£10/US$17; Vol. 3 = +£5/US$9

The Directory is available from :

IFIS Publishing, Lane End House, Shinfield, Reading, RG2 9BB UK

Tel : (+44) 01734 883895 Fax : (+44) 01734 885065 E-mail : IFIS@IFIS.ORG

Directory of Biotechnology Industries and Directory of Resource Persons in Biotechnology

BCIL has released two directories namely the Directory of Biotechnology Industries and Institutions in India (1994-95) and Directory of Resource Persons in Biotechnology. These have been purchased by companies, research institutions, and universities in large numbers and is the only complete source of information about biotech industry in India. The directories have been appreciated by many of them and many copies have been sold to foreign clients.

The Directory of Industries and Institutions of India (1994-95) lists the profile of more than 350 biotech companies, research institutions and equipment & instrument suppliers. The profile includes contact persons, turnover and exim data for the last three years, capital and manpower employed, nature of activities, international associations, and ongoing and new projects. It is an immense resource for biotech players and potential entrants.

Directory of Resource Persons lists the profile of more than 400 experts, resource persons, consultants involved in the major areas of biotechnology including agricultural, medical, health care, environmental and instrument sectors. This is a useful resource for networking with the players in the industry and use their services.

The two directories originally priced at Rs 1500 and Rs 1000 respectively, are now being offered to you a package price of Rs 1500/-.

For copies please write to : Shri Naveen Bhatia, Marketing Executive, Biotech Consortium India Limited, Kundan House, 4th Floor, 16, Nehru Place, New Delhi - 110 019.

Just Released !

Microbes for Better Living

ISBN 81-85304-98-X
Publishers : Conference Secretariat,
Defence Food Research Laboratory,
Mysore - 570 011.
Pages : About 70
Price : Rs. 400.00

This book is the compilation of the selected invited papers of Micon International-94 and 35th AMI Conference held during 9-12 Nov' 1994 at Defence Food Research Laboratory, Mysore, India - with a focal theme on "Microbes for better living". The book covers the areas of Agricultural, Basic, Environmental, Food, Industrial and Medical Microbiology. The agricultural microbiology covers microbial fertilizers for improved crop yield, which is safer, environment friendly and better than chemical fertilizers. It also stresses for microbial pesticides. In the field of food microbiology, stress is on biopreservatives, and for the control of emerging food pathogens.

The book covers the areas of microbial fuel and energy like methane, alcohol, microbial oil etc. which have great future potential. Microbes, a major tool of biochemical degradation of pesticides and toxic chemicals is explained in great detail. They also have great promise for microbial leaching of metals. The conventional technologies require high grade ores for metal extraction and the spent ores do contain residual metal especially of gold and the microbes can leach that gold. The book covers few topics of medical microbiology and competitive exclusion for disease control.

PEOPLE

Mashelkar Appointed As DG of CSIR

Dr R.A. Mashelkar has taken over Director General of Council of Scientific and Industrial Research (CSIR). He will also hold additional responsibility of Secretary to Department of Scientific and Industrial Research.

Dr. Mashelkar, who was the Director of National Chemical Laboratory (NCL), Pune, brought new concepts in research and technology management and placed NCL on the path of being a global R&D platform by offering its technologies and services worldwide. The recently adopted Mashelkar Committee report gave a refreshing new market and user orientation to the CSIR.

He has published over 180 research papers in international journals and has edited 16 books. Dr. Mashelkar has won many awards, which include the prestigious S S Bhatnagar Award (1982), K.G Naik Gold Medal (1985), FICCI Award (1987), Vishwakarma Medal (1988), O.P. Bhasin Award (1991), Pandit Jawaharlal Nehru Award for Technology (1991), G.D. Birla Award (1993) and Raj Kristo Memorial Award (1995). In 1991, the President of India honoured him with Padma Shri in recognition of his contributions to science.

Emerging vistas for partnership

CAC 95

CFTRI Annual Conference

20-21 October **1995**

Food Industry Meet

at Central Food Technological Research Institute

For the First Time
An Unique Opportunity to :

Meet and Interact with an R&D Agency on Totally Business Terms
Discuss Quality and Competitiveness
Buy / Sponsor Technologies for Specific Needs
Acquaint with Total Technology Package Systems
Experience a Four-and-half Decade Expertise and Capability
Enquire any information at any point of time on Indian Food Science & Technology for a Tailored Requirement

Registration Fee per person is Rs. 500/-

As a part of the above Conference, a poster display session by the industry is being arranged. The fee prescribed for the display is Rs. 2000/- only

An exhibition of Food machinery / equipment, packaging and food ingredients / intermediates by the industry is also being arranged. Registration fee per stall is Rs. 20,000/-

It is proposed to bring out a Souvenir on the Occasion. The advertisement rates are as follows :

a. Front Cover, Back Cover inside (4 Colour Printing) is Rs. 20,000/-

b. Thick central fold, equivalent to back cover (Total 10 nos) is Rs. 15,000/-

c. Single inner page advertisement in black and white is Rs. 7,500/-

The outside portion of the back cover will be earmarked on first-come first serve basis, the rate being Rs. 25,000/-

Make Sure you are there for this unparallelled meet with R&D, Industry and Public & Private Agencies

For More details contact
CAC Secretariat
Central Food Technological Research Institute
Mysore - 570 013
within 10 days of this notification
Tel : (0821) 37151, 22304 Fax : 0821-37453; Tlx : 0846-241 FTRI IN

AFST(I) NEWS

Bangalore Chapter

A one-day seminar on Product Opportunities in Food Industry was organized on 10 June 1995 by the Bangalore Chapter of the AFST (I). The following is an overview of the proceedings of the seminar.

Focus of the New Market Needs

One theme that emerged from the very outset was that The Consumer is King, which should inform all product development in future. Almost every speaker made the point from some angle or the other. In his opening remarks, **T. S. Nagarajan,** Convener of the Seminar Organizing Committee, stressed that a new mind-set was called for, and it was no accident that the two opening speakers were symbolic of young managers who are knocking down old perceptions, one as Director of India's premier food research institute and the other as head of the country's largest food manufacturer.

V. Prakash, Director, CFTRI, Mysore stressed the major components of R&D innovation. One was HRD at all levels of operation (indeed a symposium on this very subject had been held at Bangalore last year), stress in agriculture and horticulture on the production of raw materials of high and uniform quality, the pursuit of basic scientific research especially at University level, meaningful interaction between R&D and industry, and purposeful marketing (of which nutritional labelling was a key consumer component). In terms of products, in the area of cereals, Indian-style traditional foods had immense promise ; in fruits, the packaging of fresh fruit and the dehydration of tropical fruit ; and in dairying, the utilization of by-products like whey. He could visualize an upsurge in health and geriatric foods, sports foods and drinks, and other speciality foods.

In his keynote address, **R. Gopalakrishnan,** Vice-chairman and Managing Director of Brooke Bond-Lipton Indian Ltd., Bangalore, drew attention to the triangle between innovation, marketing and developing, all with the consumer at the very centre. Currently, there existed several growth-drivers for processed foods (rapid economic growth, socio-cultural changes, alterations in food habits and outlook, new and better technologies). A shift was occurring from a mechanically-driven to a market-driven food industry, and an enormous rural market was opening up. Traditional housewife perceptions of what constituted freshness and staleness were being replaced by those of convenience, health, hygiene and safety, with children adding their own pressures. Food product development had constantly to be integrated with the consumer, and for such innovativeness, it was permissible to beg, borrow and even steal ideas.

Chairing a session, **Kiran Mazumdar,** Biocon India Ltd., Bangalore remarked that while abroad, each of the last three decades had been characterized by specific thrusts, suddenly in India we are confronted with all of them in a rush-efficiency, quality, productivity and product development. There had to be innovation at all steps in the chain - processes, products and above all marketing to the consumer. The scenario unveiled by the representative of Marketing and Business Associates, Bangalore showed, perhaps rather surprisingly, that may high-growth food products were will suited to small-scale enterprises, which had, however, to ensure hygiene, quality and reasonable cost. Since the buying decision was that of the housewife, she needed as much information as possible on the product offered.

Fruits and Vegetables

In this area, in the view of **M. S. Parikh** of WIMCO Ltd., Bangalore, certain new technologies could enormously widen the product range in fruit pulps, pastes and concentrates. These were aseptic packaging, evaporative cooling and use of scraped-surface heat exchangers. There appeared to be market opportunities in packaging fresh fruits and vegetables, in fruit dehydration, and in fruit pulps and tomato products, besides in RTE beverages.

Some desiderata for export were furnished by **A. D. Borwankar** of Temptation Foods Ltd., Pune. To ensure some buffer against market lapses, a flexible product mix and a widespread marketing network were desirable, though expensive to set up and time-consuming. Contract farming to ensure raw material quality, interfaces with equipment manufacturers and emphasis on hygienic practice would all pay

off eventually. It was often an advantage to think small and plan thoroughly, and let size grow from inner strength.

Milk Products

A SWOT analysis of the Indian dairy scenario was employed by **J. S. Punjrath** (NDDB, Anand) to suggest further directions for its development. The key role that skim milk powder had played in equalizing seasonal milk fluctuations was now diminished as production has grown, though it had still a place in product manufacture. New product development, essential to the growth of any food industry, could benefit from new technologies like membrane separation, fat fractionation, and fat and cholesterol reduction. Geared to consumer perceptions, these could suggest such products as low-fat and low-cholesterol ice-creams, fat substitutes, infant foods and high shelf-life products. Even familiar products like ghee, butter, bread spreads, ice-cream and beverages were well suited to innovation with technological inputs. For example, the NDDB had been able to develop a *paneer* of almost indefinite shelf-life, which obviously had enormous possibilities.

S. E. Chinoy of ABC Farms Pvt. Ltd., Pune remarked that when unripened *paneer* was so popular in India, ripened cheeses of different kinds could well find their special market niches. Ricotta, Mozzarella and Cheddar were well-suited for household use, certain Italian cheeses like Parmagiano for commercial kitchens, and stronger products for the gourmet palate. There were export possibilities for Indian-made cheddar-based processed cheeses. Cheese-making equipment was simple and highly mechanized, though hygiene was of course a paramount necessity. Among other fermented products, there appeared to be scope for a standard packaged *dahi*, for therapeutic acidophilus milk, for bifidus milk for children, and for fruit, falvoured and carbonated whey drinks.

Cereals

The market success of the **Kellogg** operation in India could be attributed to a combination of strengths. On the one hand were product quality, brand-name familiarity and nutritional image, and on the other financial strength, global networking, technological excellence, partnership with Indian interests and conscious social interaction.

Sailesh Patel, Aurofood Ltd. Auroville made a strong case for ethnic foods as market commodities, with emphasis on convenience, taste, packaging, hygiene and machinery development as components. A lucrative line of activity for cereal processors was the supply of really high-quality raw materials for use by product manufacturers.

K. S. Premavalli, Defence Food Research Laboratory, Mysore pointed out that only 10 percent of cereals were now used for value - addition. She perceived three categories of products and more sophisticated factory-made products each suited to a different level of operation ; traditional products, industrial products and more sophisticated factory made products. Examples were given of each of the based on wheat, rice and coarse cereals. New technologies like flaking, extrusion, high pressure cooking and freeze-drying had enormous scope in extending product possibilities as had been demonstrated by products developed at DFRL, Mysore, all of which were available not just for defence use, but for all entrepreneurs.

Headquarters

ICFoST-'95

Curtains were rung down on the afternoon of 9, September 1995, to mark the successful completion of ICFoST'95 at the IFTTC, Auditorium, CFTRI, Mysore. Three Karnataka State Ministers, Hon'ble Shri S. Siddaramiah, Finance Minister, Hon'ble Shri P.G.R. Sindhia, Home Minister and Hon'ble Shri D.T. Jayakumar, Horticulture Minister were present during the valedictory function and addressed the gathering. Various annual awards of the Association were presented to a distinguished set of scientists. A detailed report of the proceedings and recommendations will be published in the next issue of our Jounral .

Chief Editor

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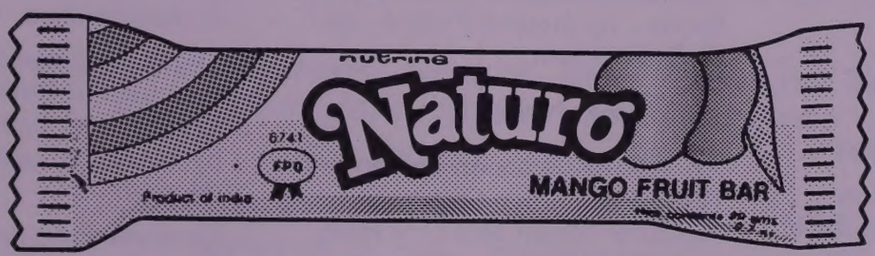

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JOURNAL OF FOOD SCIENCE AND TECHNOLOGY

Volume 32 Number 5 SEPTEMBER/OCTOBER, 1995

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